

Product Information

DE27CW1, DG27CW1



Update: February 2007

**Compiled by
Product Evaluation, Auckland**

AEROSMART

Fisher & Paykel
innovative living

Table of Contents

THE IDEA	4
SPECIAL FEATURES	5
SPECIAL FEATURES	6
FREQUENTLY ASKED QUESTIONS	7
AEROSMART UNDER ANALYSIS	9
AEROSMART DRYER LID LABEL USER GUIDE	11
THE AEROSMART ADVANTAGE – KEY CLAIMS... ..	12
AEROSMART DIFFERENCE	13
THE THEORY OF DRYING CLOTHES.....	15
DRYING STAGES.....	16
HOW DOES AEROSMART DRY CLOTHES?	17
AUTO SENSING	17
DRYNESS LEVELS	18
DRYING CYCLES EXPLAINED.....	19
TESTING	20
AEROSMART'S INNOVATIVE LINT REMOVAL SYSTEM	23
WRINKLING	25
TANGLING.....	26
EVENNESS OF DRYING.....	27
EVENNESS OF DRYING.....	28
HEAT VS CLOTHES CARE.....	35
PERMANENT PRESS CARE.....	36
SPEED VS CLOTHES CARE	37
SUMMARY	40
DRUM PARTS	43
DRUM CONTROL	44
SUB DECK ASSEMBLY	45
DRUM OPENING AND CLOSING.....	46
AIRFLOW	48
LINT REMOVAL SYSTEM	48
LINT REMOVAL SYSTEM	49
HEAT	50
ELECTRIC ELEMENTS	50
GAS BURNER.....	51
FAN	53

MOTOR.....	54
DRYER CONSTRUCTION	55
GRILL	55
WRAPPER.....	55
USER INTERFACE/DISPLAY.....	55
TOPDECK.....	57
LID.....	57
LIDLOCK	57
VANES	57
LINT BUCKET	58
DRUM WRAPPER AND DRUM ENDS	58
INLET BEARING.....	58
OUTLET BEARING.....	58
CHASSIS	59
SELF LEVELLING FEET.....	59
BELT TENSIONER SYSTEM	59
BASE	59
PRODUCTS.....	60
IN DRYER DRY-CLEANING PRODUCTS.....	60
FABRIC SOFTENER SHEETS	62
SERVICING	63
HOW DOES THE DRYER ROCK OUT?	63
USER WARNINGS.....	70
CUSTOMIZING THE LANGUAGE THAT YOUR AEROSMART DRYER USES	71
DEMO MODE	71

The Idea

The objective for Aerosmart was to develop a more fully featured version of the Smartload dryer to match the AquaSmart washer, including an LCD display to offer increased functionality. And to offer Fisher & Paykel's first multi-lingual dryer.

The original Smartload dryer project began on the 11th of October 1998 with a single one-hour meeting. After 1166 days of design and testing it was finally ready to be released.



The aim of this project was to design the first top loading, large capacity dryer. We wanted to create a dryer that combined sophisticated innovative design and functionality, with unmatched ergonomic advantages for the consumer.

There were three key requirements, which had to be implemented within the design.

- Load Size
- Cycle Time
- Visual Match



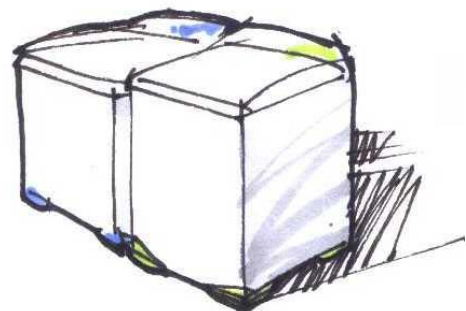
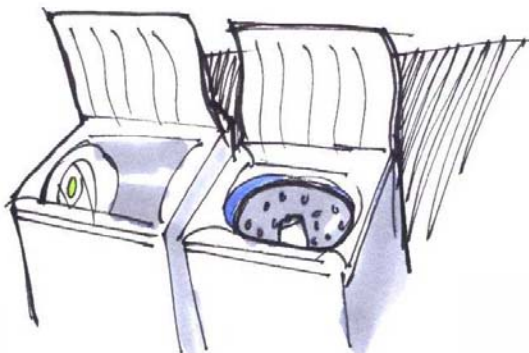
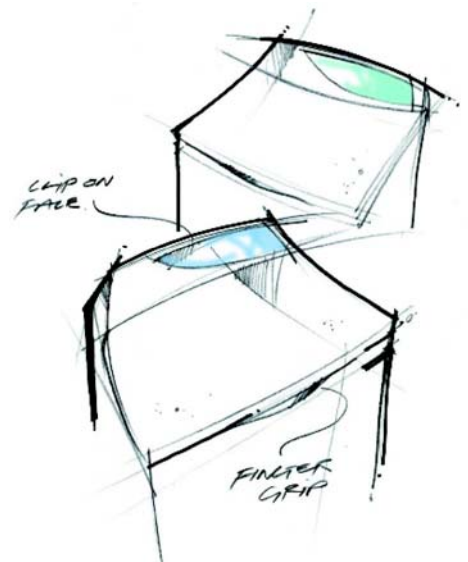
It had to be able to dry large loads, dry them quickly and needed a matching washing machine.

The opportunity to design a full sized dryer that matched the Intuitive washer arose.

Once the brief was created we had the choice of designing a standard dryer or doing something innovative. Knowing that Americans had a strong preference for top loading washers we started looking at ergonomics. This is where the idea of top loading developed, accessing the drum from the top rather than the front.

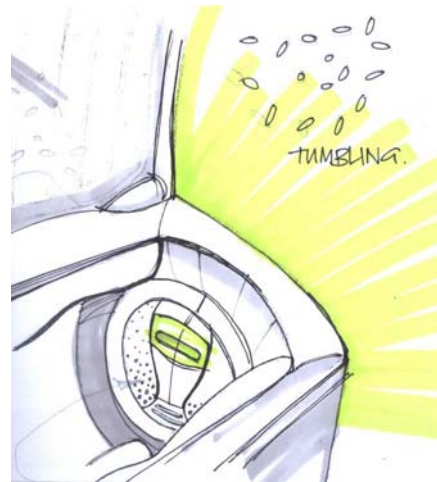
Enhancing ease of use through ergonomics and surface form was our main priority. We also wanted to design a dryer with an enhanced overall appearance, in an effort to give it more solidity within a crisp, clean modern look.

We designed the dryer with a similar philosophy to the washer, giving it a strong, solid feel through curved surfaces. We have continued, and enhanced, the interface logic to ensure that the dryer is as easy to use as the washer. All the external features of the washer have been replicated by the AeroSmart design to guarantee they are truly a matched pair.



One of the key aspects to this design was to have a single action access to allow the user to access the dryer with minimal effort.

This was when the concept of automating the drum door opening arose.



Concept models and prototypes of the initial Smartload concept were tested and evaluated by users. People of different ages, heights and abilities helped in the development. By understanding how people used the dryer we were able to understand how we could make it better and easier for them both functionally and ergonomically.



Conventional front loading dryer



AeroSmart top loading dryer



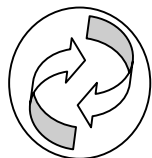
Simply move clothes from the Washer to the Dryer.



Special Features



- **Unique top access:** Superior ergonomics designed for easy loading and unloading. The wide mouth opening makes transferring clothes from the washer to the dryer effortless, no need to bend! The wide mouth opening provides better visibility into the drum, and easier access to the clean clothes.



- **Reverse Action Tumbling:** AeroSmart reverses its tumbling action every 4 minutes. This reverse action prevents tangling and twisting of large items, improves evenness of drying and reduces creasing, resulting in great clothes care.



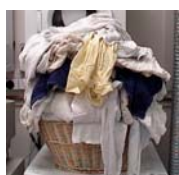
- **Automatic Lint Removal System:** The Lint filter is automatically scraped clean during the drying cycle and the lint is deposited into the removable lint bucket – eliminating the need to deal with messy lint filters. Efficient lint management keeps airflow and performance at a maximum. Positioned for simple access and removal, the large-capacity lint bucket captures and stores lint for easy disposal.



- **Matched Pair:** The AeroSmart Dryer makes a smart pair with the AquaSmart washer, moving items from one to the other is a breeze. The AeroSmart dryer combined with the AquaSmart's superior spin performance and quick cycle times will cut washing time dramatically.



- **Smooth surfaces:** The smooth top deck surface allows fabric to slide into the drum.
- **Stainless Steel Drum:** Hygienic and durable stainless steel drum will last a lifetime, won't chip or stain, and is very gentle on clothes.
- **Increased Motor and Fan Speed:** 2300rpm creates lower drying temperatures and producing greater airflow.



- **Super Capacity Plus** (6.5 cubic feet) the AeroSmart dryer is able to dry up to 17½ lb (8kg) of laundry.
- **Wrinkle Free Option:** Intermittently rotates the drum to reduce creasing and wrinkling, long after the cycle has finished.



- **So many choices:**
 - * **7 fabric - based drying cycles, 6 Bulky cycle options and 18 specialty Lifestyle cycles** including Allergy, Dry Clean, Fashion Jeans, Soft Toys, Sportswear Light.
 - * **5 Dryness Levels** - Damp, Damp/Dry, Dry, Dry/Extra Dry, Extra Dry.
 - * **2 Drying Methods** – Auto Sensing or Time Dry.
 - * **4 heat settings including Air Dry.**
 - * **3 Language Options Available** – English, French (Canadian), Spanish



- **Superior Clothes Care:** Better clothes care is accomplished by an efficient high airflow fan and careful heat control. AeroSmart provides the right heat for temperature sensitive delicate articles while still efficiently drying more robust regular and denim loads.

Frequently asked Questions



1) **Why does AeroSmart Stop and Start all the time?**

The AeroSmart dryer has Reverse Action Tumbling. It tumbles in one direction for 4 minutes then stops, and tumbles in the opposite direction for 40 seconds. This reduces tangling, roping and wrinkling and increases drying performance by giving you more even drying.

2) **What is that noise AeroSmart makes after I press Start?**

This noise is AeroSmart locking the lid and closing the drum.

3) **What are the different drying options and what are they designed for?**

Drying Cycles	Description
Regular	A high heat setting for drying every day clothing and linen. This cycle is suitable for most garments labelled 'Tumble dry'
Bed Sheets	This cycle has been designed to complement the AquaSmart SHEETS cycle. This autosensing high heat cycle has Wrinkle Free automatically selected to reduce wrinkles and ensure the best result possible for cotton and poly cotton sheets.
Heavy	Designed to provide a long, high heat cycle for heavy fabrics and denims that tend to have thick and bulky seams.
Delicate	This light cycle is great for delicate or heat sensitive items, as it restricts the cycle to a low heat. Use this setting when care labels recommend a low heat setting.
Easy Iron	This setting uses a medium heat combined with the selection of the Wrinkle Free option. It is ideal for reducing the need to iron garments once the cycle is complete.
Casual	This setting uses a medium heat for light-weight fabrics. It is ideal for light-weight cottons and items labelled 'Tumble with a medium heat'.
Bulky	This drying selection offers 6 customised Bulky cycle options – Comforter, Blanket, Jacket, Pillows, Throw, Sleeping Bag. This ensures the right drying conditions for each item type.
Air Dry	For items that require drying without the use of heat. Perfect for airing clothes or drying delicate garments

In addition to these main drying cycles there are an additional 18 pre-programmed speciality Lifestyle cycles for exceptional drying results with no experience necessary.

4). **How often do I have to empty the Lint Bucket?**

You need to empty the lint bucket before it reaches the top of the transparent section. How often you empty it depends on the types of garments that you dry in your dryer. You will need to empty it approximately once a week. If you dry a lot of towels you will need to empty it more often. AeroSmart will remind you after every 5th cycle to empty the lint bucket if it is full.

5). *What happens if I forget to empty the Lint Bucket?*

If you don't empty a full lint bucket, drying times will increase. An empty lint bucket also ensures your clothes will remain lint-free and your dryer will operate at maximum efficiency. If your lint bucket has overflowed, empty it and place it back into the dryer. Run your dryer for 20 minutes with no load to remove any lint that is stuck in the Lint Removal System.

6). *Can I use Fabric Softener Sheets in my dryer?*

Yes you can.

Just make sure they are labelled dryer safe and always follow the instructions on the packaging. Its important not to place them in a dryer with warm clothes as there is a chance the fabric softener may stain clothes. Only use a softener sheet once, then discard it.

7). *How many clothes can AeroSmart dry?*

Your AeroSmart dryer has a 17½lb (8.0kg) capacity. You can load clothes to the top of the transparent section of the lint bucket.

8). *I have pressed START/PAUSE to stop my cycle early but the lid will not open!*

The dryer takes approximately 15 seconds to open the lid after you have pressed START/PAUSE. This is because AeroSmart has to open the drum before it can unlock the lid.

9). *There has been a power cut and I want to get my clothes out, but the drum is not open what do I do?*

When the power is restored, AeroSmart will automatically relocate itself back in the open position, as long as you have the lid closed. If the power is expected to be lost for an extended period of time you can open the drum yourself. Refer to your User Guide for step-by-step instructions.

10). *How do I set my dryer up to operate in my preferred language?*

The first time that you turn your dryer on and initial set-up mode will be initiated. The set-up mode will prompt you to select the language that you would prefer your AeroSmart dryer to use.

Using the SCROLL buttons, scroll to the language that you would like your dryer to use. Once the language icon has been highlighted, press SELECT to confirm your choice. Your dryer will now use this language and the initial set-up prompt will not appear again.

If you wish to change your language choice at any time, you can do this by simply selecting the LANGUAGE option in the SETTINGS MENU.

AeroSmart Under Analysis

Maximum Temperature of the Exhaust

Drying Cycle Selection	Heat Setting	Max Exhaust Temperature
Regular	Medium +	149°F (65°C)
Bed Sheets	Medium +	149°F (65°C)
Heavy	High	149°F (65°C)
Delicate	Low	127°F (53°C)
Easy Iron	Medium	140°F (60°C)
Casual	Medium	140°F (60°C)
Bulky	Dependent on Bulky option chosen	
Air Dry	No heat	Dependent on Room Temp

Heat (When it is turned on and for how long)

	Closed Direction (4 minutes)		Open Direction (40 seconds)	
	3600W Element	1400W Element	3600W Element	1400W Element
Regular	ON	ON	OFF	ON
Bed Sheets	ON	ON	OFF	ON
Heavy	ON	ON	OFF	ON
Delicate	ON	OFF	OFF	ON
Easy Iron	ON	OFF	OFF	ON
Casual	ON	OFF	OFF	ON
Air Dry	OFF	OFF	OFF	OFF

Target Moisture Contents

Dryness Setting	Delicate	All Others	Cycle Progress	When displayed
			Drying	Before "Dryness determined"
	20%	30%	Drying & Damp	From "DAMP" to "DAMP & DRY"
Damp	8%	11%	Damp	From "DAMP" to "DAMP & DRY"
Damp & Dry	5%	7%	Damp & Dry	From "DAMP & DRY" to "DRY"
Dry	2%	4%	Dry	From "DRY" to "DRY & EXTRA DRY"
Dry & Extra Dry	1.5%	3%	Dry & Extra Dry	From "DRY & EXTRA DRY" to "EXTRA DRY"
Extra Dry	1%	2%	Extra Dry	when "EXTRA DRY"

AeroSmart Dimensions

	Measurements
Height	40 1/8" - 41 3/8" / 1020mm - 1050 mm
Width	27" / 685mm
Depth	25 3/8" / 700mm
Height with lid open	55 1/2" - 56 3/4" / 1410 - 1440mm
Capacity (dry load, IEC)	6.2 cu ft

Note: Exact height of AeroSmart is dependent on how far the feet are inserted into the base of the dryer.

Electrical Supply	Operating Voltage	Maximum Current
Electric	240V AC 60Hz	24 amps

AeroSmart Cycle Times

Drying times can be affected by a number of factors including:

- The cycle chosen
- Load size
- Size of the items
- Type of fabric
- Load wetness
- Venting method
- Location of the dryer
- Condition of exhaust ducts
- Heat used (electric, natural gas or LPG gas)



AeroSmart Dryer Lid Label User Guide

The Lid label guide has been designed and included on the underside of the lid to help the consumers in their general day-to-day running of the product.

This guide is an attempt to educate a new user on the correct use of their Aerosmart dryer.


Field-testing has indicated that consumers are more likely to refer to the lid label than they are to the User Guide. This label provides the first point of reference for a user, and the User Guide elaborates on these important instructions.


There is also another label attached to the lid illustrating important warnings that need to be displayed to all users.

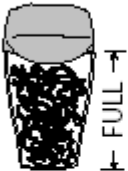
Refer to your User Guide, or www.fisherpaykel.com

For more information or advice, please call
USA and Canada Toll Free 1 888 9 367 872
New Zealand Toll Free 0800 37 2273
Australia Toll Free 1 300 650 590

CAUTION: If cycle is interrupted before cool down, parts of the drum may be hot.
IF YOUR DRYER DRUM DOOR WILL NOT OPEN refer to your User Guide for more information.

 **Sorting**
To ensure your clothes are evenly dried, sort items according to size and thickness.

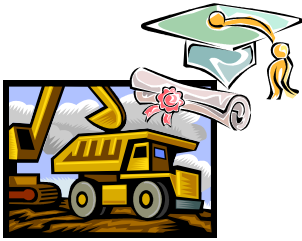
 **Loading**
Load clothes no higher than the top of the transparent section of the lint bucket.

 **Lint Bucket**
Check to see if the lint bucket needs emptying. Empty before the lint reaches the top of the transparent section.

Press **POWER**, select cycle and dryness level, press **START/PAUSE**.

Part No. 395702

The AeroSmart Advantage – Key Claims...



Smartest Loader:

Utilizing SmartLoad technology – the world's first Top-Loading, large capacity dryer.

The most easily accessible dryer available.



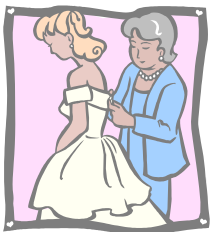
Largest Visible Capacity:

AeroSmart has easy drum access and is capable of drying a 17½lb (8kg) dry load.



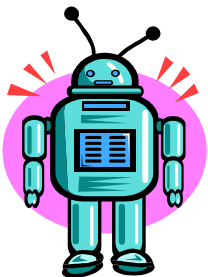
Improved Drying Performance:

Reverse Action Tumbling is the key to even drying, resulting in less wrinkling and fabric damage.



Better Clothes Care:

A range of cycles provide the right heat for all garment types through an efficient high airflow fan and careful heat control.



Most Efficient Dryer:

The Automatic Lint Removal System means AeroSmart retains optimum performance throughout the entire cycle.

AeroSmart Difference

What makes this dryer so different?

Top Loading Dryer

The SmartLoad system is the first top-loading large capacity dryer.

The obvious benefit of this is that it's ergonomically superior. The difference with our AeroSmart drying system is that you don't need to squat down and reach into the back like you do with a conventional dryer.

We wanted people to be able to transfer their clothes from the top of the washer into the top of dryer.... It's as simple as that.

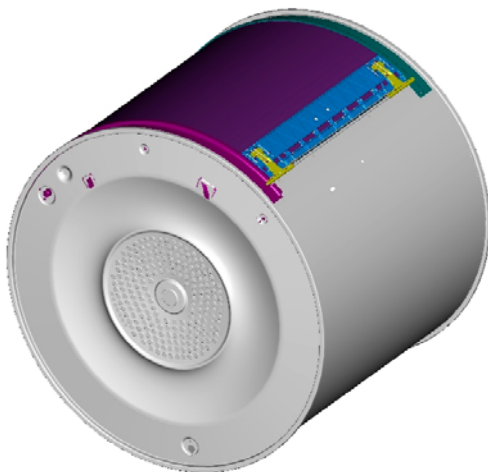
One of the technical challenges we had in designing a top loading dryer was having to automatically open and close the drum door. As the consumer never sees the drum door, we had to automate the drum opening.

Three Phase Induction Motor

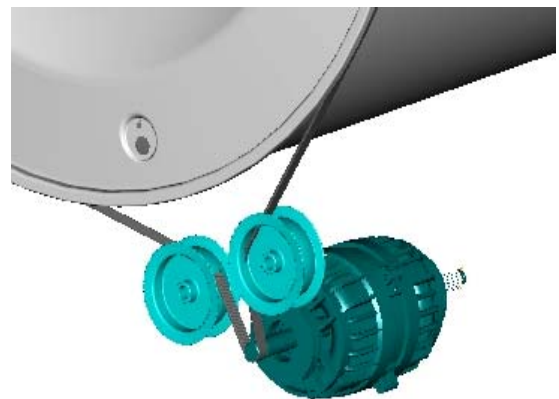
In all dryers the fan is attached to the motor, which determines the maximum amount of airflow that can be produced. All US dryers are single-phase induction motors that run at a fixed speed of ~1700rpm. The AeroSmart dryer is the only dryer to be designed with a variable speed three-phase induction motor that can run at ~2300rpm.

The benefits of this include:

- Being able to produce greater airflow and pressure than any of our competitors, allowing us to get more air flowing through the clothes. The result is we have lowered the airflow temperature to give better clothes care, while still maintaining a competitive cycle time.
- We are able to use a finer filter in our lint removal system. It's a 200 micron mesh (the holes in competitor lint filter mesh is up to 10 times bigger). The result is that we can catch more lint at the filter and less is deposited in the ducting. This helps ensure better quality airflow throughout the life of the product.



AeroSmart's Drum



AeroSmart's Motor and Belt Tensioner System

Reverse Action Tumbling

We have been using Reverse Action Tumbling successfully in our Australasian dryers for over 30 years. By applying this technique to the AeroSmart dryer we are able to gain significant benefits for the consumer.



Benefits of reverse action tumbling include:

- Less tangling
- Less roping of large items eg. sheets
- Less creasing and wrinkling of garments
- More even drying performance



This will result in less time ironing and less time spent re-drying items.

Lint Removal System

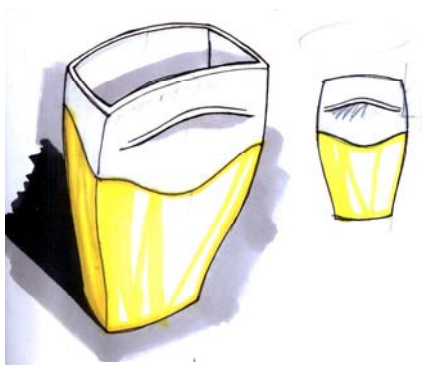
Another feature unique to the AeroSmart Dryer is the Lint Removal System, and especially the bulk lint bucket. The idea behind this design was to remove the hassle of having to scrape messy lint filters by hand between each cycle.

The mesh of the lint filter is constantly cleaned throughout the cycle, which eliminates the lint build up that causes reduced performance, ie the airflow through the dryer doesn't deteriorate as the cycle progresses.

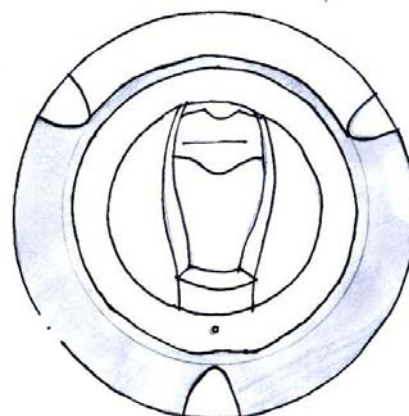
The lint is automatically scraped from the filter mesh and is deposited in the lint bucket. The lint is then stored until it is convenient for the consumer to dispose of it .

Benefits of the Lint Removal System include:

- Not having to remove the lint after every cycle.
- Drying performance is not reduced from a blocked filter.



Bulk Lint Bucket



The Theory of Drying Clothes

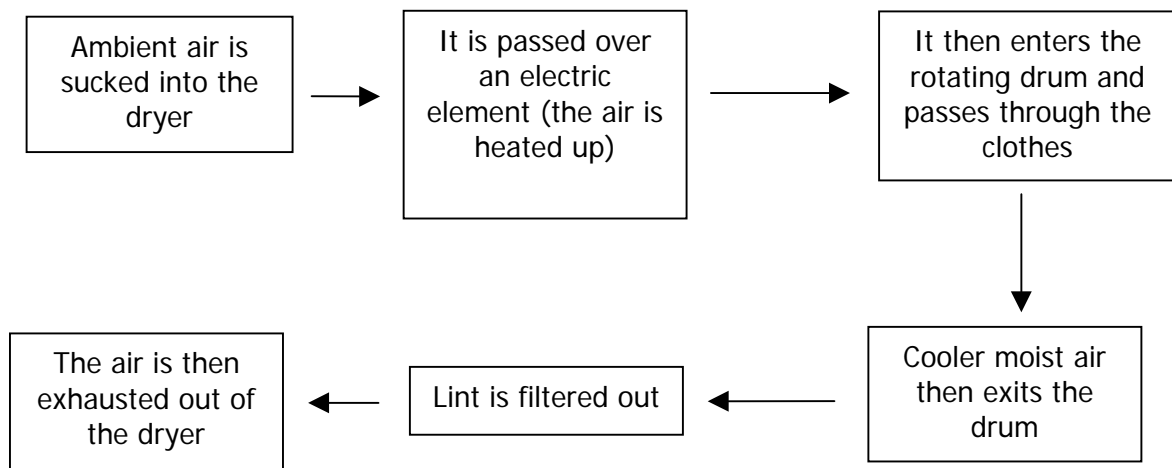


An electric heater or a gas burner replaces the sun's heat. This provides the heat source.

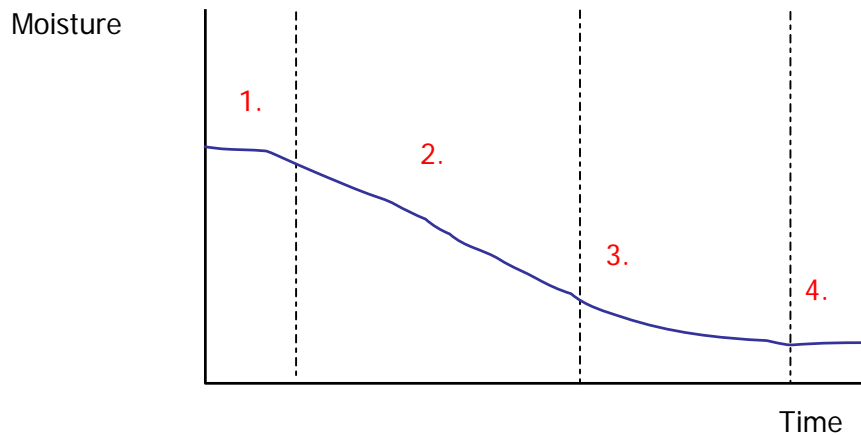


A fan provides the wind or airflow over the clothes.

How does a dryer work?



Drying Stages



- 1) **Warm Up:** Clothes are being warmed up from their ambient conditions. This period is usually short in duration (up to 25 minutes for large loads).
- 2) **Steady State:** This is where the bulk of the drying is performed.
- 3) **Post Critical Moisture Content:** All moisture on the outside of the fabric has been removed. The only moisture left is moisture sitting between the inter-woven fibres. At this stage the moisture content of the clothes is 20 to 30%. This is where the dryer uses its sensing to determine how long to continue to dry for (which is depended on the cycle chosen and the dryness level required). See Dryness Levels.
- 4) **Cool Down:** Clothes have reached their targeted moisture content. The dryer then cools the clothes to an acceptable level and turns off.

How Does AeroSmart Dry Clothes?

Auto Sensing

The Principle...

When wet or damp clothes are loaded into a dryer they are partially saturated with water, which is a relatively good conductor of electricity. In the AeroSmart Dryer we use **Sensor Bars** to measure the conductivity. When moisture in the clothes touches across the Sensor Bars (located beneath the lint bucket) their conductivity is measured. As the clothes dry they become less conductive, and it is this measurement that is used to calculate the dryness of the clothes load.

Large loads will brush against these moisture sensor bars more frequently than small loads, and this strike count is used to help determine the dryness of different sized loads.

Different fabrics retain moisture differently; a thick towel containing a lot of moisture will often conduct the same as a light synthetic garment containing very little. It is this difference in fabric characteristics plus the initial unknown moisture content that makes the calculation of dryness reasonably complex. This is also the reason why loads need to be sorted, particularly Delicate from non-Delicate items.

A temperature sensor located in the exhaust duct is used to limit the temperature of the various cycles. The temperature limits are to provide clothes care for the different fabric types. The table below shows the temperature limits in the exhaust for the various cycles:

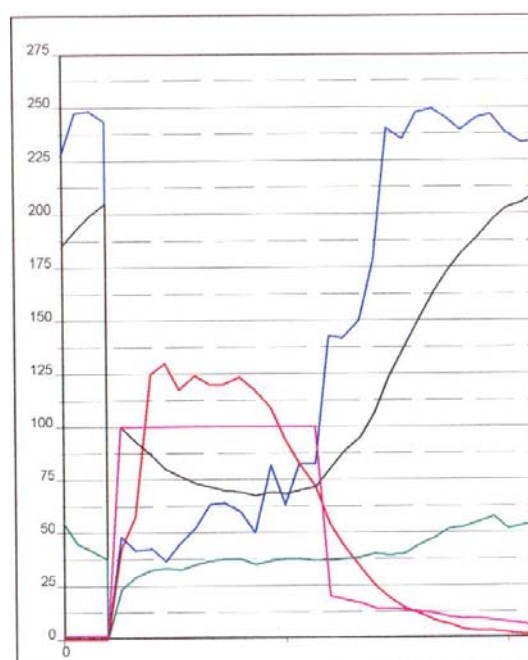
	Regular	Sheets	Heavy	Delicate	Easy Iron	Casual	Air Dry
Max Exhaust Temperature	149°F (65°C)	149°F (65°C)	149°F (65°C)	127°F (53°C)	140°F (60°C)	140°F (60°C)	Room Temp

The clothes in the drum will be slightly hotter than these temperatures as the air has cooled down slightly by the time it reaches the exhaust.

Information Used for Auto Sensing:

Each time a strike is made across the Sensor Bars the measurement of conductivity is recorded. During each minute the lowest resistance measurement is recorded, as well as a measurement of the number of strikes which are averaged with previous measurements. These two measurements are used to calculate the **dryness** of a clothes load. In Smart Tool the averaged lowest resistance is called **Trend** and the number of strikes is called **Strike Count**.

- Strike Count
- Calculated dryness (%)
- Trend
- Exhaust Temperature
- Lowest Resistance



Dryness Levels

There are 5 dryness levels the user can select.

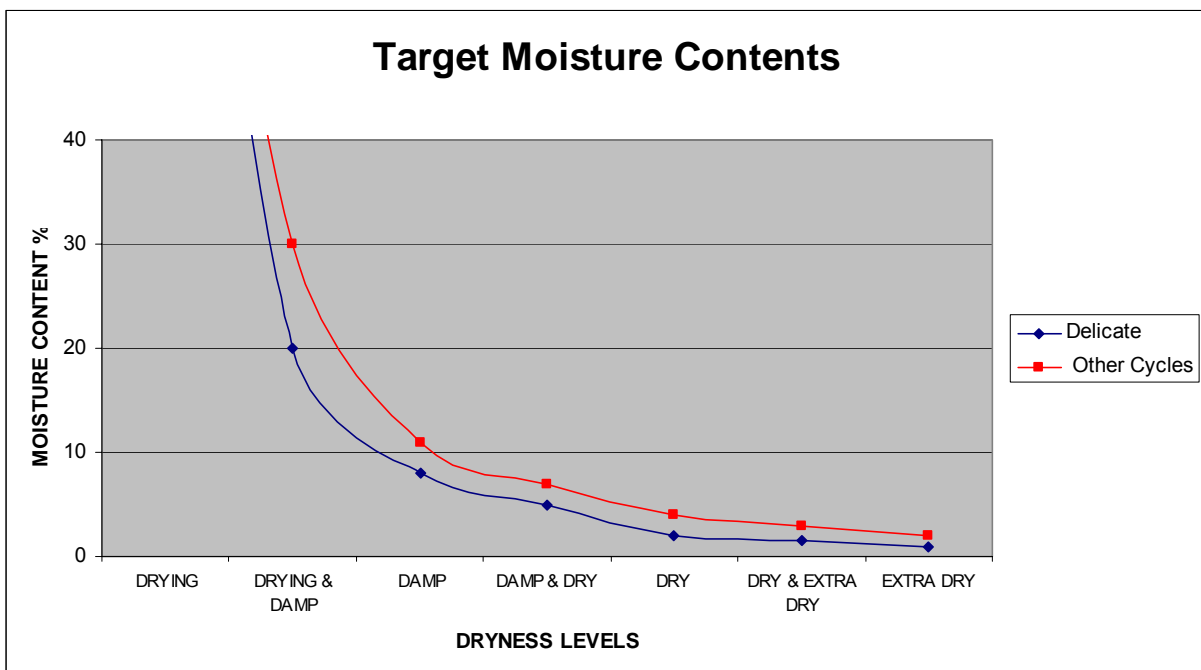


Damp Garments are considered 'moist'	Damp+ (Damp/Dry)	Dry Garments are considered 'dry'	Dry+ (Dry/Extra Dry)	Extra Dry Garments are 'extra dry'
Suitable for delicate, light-weight fabrics, and garments which you may wish to iron dry		Designed to provide items dry enough to be worn immediately		Useful for drying items that you wish to store (cupboard dry)

The setting the user selects determines what moisture content the AeroSmart dryer will aim to reach. The table below shows the different moisture contents for the different cycles and dryness levels.

Note: Because of the characteristics of delicate fabrics they are perceived damp when the total % moisture content is less than other fabric types, this is because much of the moisture left is on the surface of the fabric. This is reflected in the table below where our target moisture contents are lower for delicates.

Dryness Setting	Delicate	All Others	Cycle Progress	When displayed
			Drying	Before "Dryness determined"
	20%	30%	Drying & Damp	From "DAMP" to "DAMP & DRY"
Damp	8%	11%	Damp	From "DAMP" to "DAMP & DRY"
Damp & Dry	5%	7%	Damp & Dry	From "DAMP & DRY" to "DRY"
Dry	2%	4%	Dry	From "DRY" to "DRY & EXTRA DRY"
Dry & Extra Dry	1.5%	3%	Dry & Extra Dry	From "DRY & EXTRA DRY" to "EXTRA DRY"
Extra Dry	1%	2%	Extra Dry	when "EXTRA DRY"



Drying Cycles Explained

The cycles in the Aerosmart dryer have been designed to complement those on the Aquasmart washer. This provides continuity for the consumer, enabling them to use the same cycle for their load in both the washer and the dryer. The way in which items are dried is dependent upon the type of fabric type that is selected.



REGULAR: This cycle is programmed to dry a mixture of items, towels, shirts, pants etc. When it senses the load as nearly dry it provides a further fixed drying time based on the size of the load



BED SHEETS: This cycle has been designed to complement the AquaSmart SHEETS cycle. This autosensing high heat cycle has Wrinkle Free automatically selected to reduce wrinkles and ensure the best result possible for cotton and poly cotton sheets.



HEAVY: Because of the water holding nature of heavy fabrics and denim, moisture gets trapped inside the thick seams and takes time to remove. Even though the surface dries the inner fabric still contains moisture. The sensor module is programmed to allow for more time for the moisture to be drawn out. Once it senses the clothes load is nearly dry it continues to dry for a fixed time to dry the bulky seams.



DELICATE: The calculation of dryness assumes that once the surfaces of the garments are dry, the garments are dry. Underwear or delicate cotton items will sometimes under-dry. The cycle has been designed in this way to guard against over-drying and ensure that delicate items are safely cared for.



EASY IRON: Like the Casual cycle, Easy Iron uses moderate heat, but the Wrinkle Free option is also automatically selected for this cycle. At the completion of the cycle the drum will continue to rotate periodically (without using any heat) until the user returns to remove their clothes. This reduces the chance of creases and wrinkles forming in the load – especially if you're not sure when you will be able to return to remove clothes once the cycle finishes.



CASUAL: When AeroSmart dries these clothes it uses a moderate heat. The assumption made is that there are no heavy items in the load such as towels. The time allowed at the end of the cycle is similar to the Regular cycle.



BULKY: Bulky items can be very tricky to wash and dry. That is why we have developed 6 special Bulky cycle options – Comforter, Blanket, Jacket, Pillows, Throw, Sleeping Bag.



AIR DRY: Does not use auto sensing, timed dry only. 3 time options. Not heat.

Testing

A wide range of testing has been conducted during the development of the AeroSmart Dryer.

Testing has included:

Cycle Development: Cycles have been developed using a wide variety of clothes loads. The loads were weighed before and after drying. But more importantly each garment was felt for dryness just as a user would.

Product Useability: A wide range of people have given us feedback on the useability of this product including those with disabilities, pregnant woman, and the very tall and short.

Temperature Testing: Thermo labels have been attached to garments to determine how hot they get when they are being dried. This testing was to ensure heat sensitive garments were not subjected to high temperatures.

Home Laundry: Staff have done their own laundry in the laboratory. This helps us confirm that the development we have performed is suitable for real clothes not just test loads.

Field Testing: This product was placed in homes in Auckland, Dunedin, Los Angeles, Southern California, Lake Tahoe, Chicago, Orlando, Knoxville, Seattle, Portland and New York. Not only does this give us feedback on a range of installation conditions but it tests AeroSmart under different user habits.

Life Testing: Machines are run continuously to see which parts fail and when.

Reliability Testing: Products manufactured on the line are checked and tested to ensure that performance criteria are met.

Auditing: Products are stripped down and inspected to determine the effects of use, and wear and tear of parts.

MEOST Testing: This is overstress testing to develop robust products.

Packaging Trials: Machines are packed up and shipped to the USA and back again to check for damage.



Ergonomics and Ease of Use

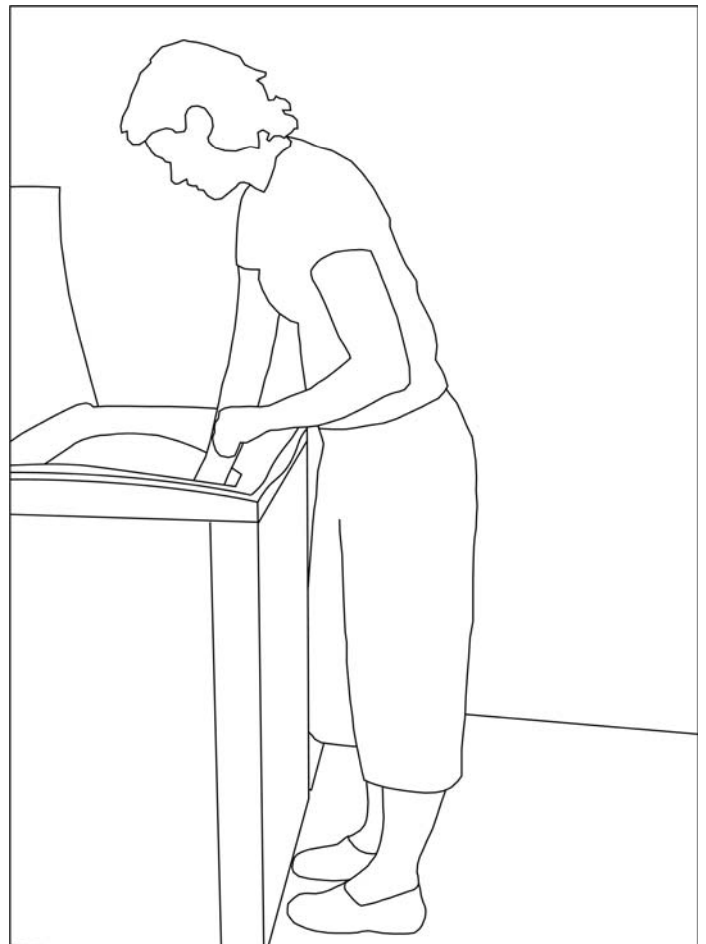
During our testing we have experienced first hand the ergonomic advantages of the AeroSmart dryer. We have bent, crouched, and stretched our way into three traditional large capacity, front access dryers and found that the benefits of improved access are immediately apparent to the user.

AeroSmart's top load wide-mouth access benefits the consumer by:

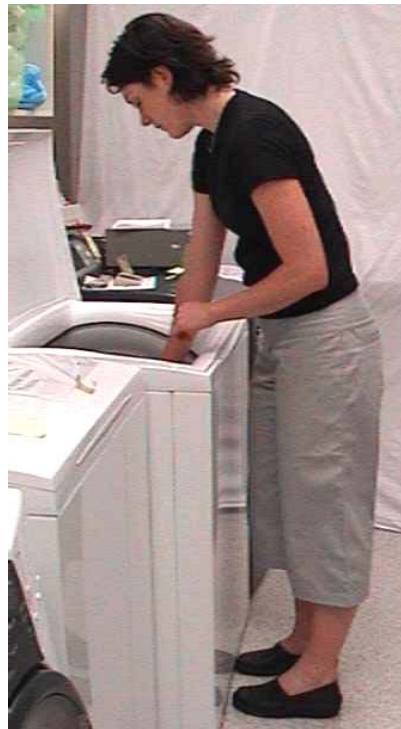
- Reducing the amount of bending, crouching, and stretching required to access garments.
- Making it easier to see what's in the dryer - easier to see if items are missed.
- Enabling laundry to be folded straight from the dryer - no more clean items dropped onto the floor.



Traditional front access dryer



AeroSmart top loading dryer



AeroSmart's Innovative Lint Removal System

Traditional methods of lint capture and disposal can be very messy and inconvenient.

Lint found in dryer filters can be made up of a number of components – dust (skin particles), small broken fibres and fabric fluff, pet hair and dust mite remains.

Traditional Large Capacity Front Access Models



AeroSmart



It was clear to us when we used these lint removal systems that the AeroSmart dryer provides clear advantages over its competitors for consumers.



When released into the air and subsequently inhaled, the particles that make up lint can be a serious irritation for allergy sufferers.

The AeroSmart bulk lint collection system minimizes the amount of lint particles released into the air by automatically scraping lint off the filter and depositing it into the lint bucket. The user then is able to empty the lint balls from the bucket without direct skin contact with the lint. And, because the lint is already formed into balls automatically, the amount of lint released into the air when lint is transferred to the rubbish bin is minimized.

This makes the AeroSmart lint system the smart choice for allergy sufferers.

AeroSmart's bulk lint collection system means no more cleaning messy lint filters, just pour the lint balls from the bucket into the trash.



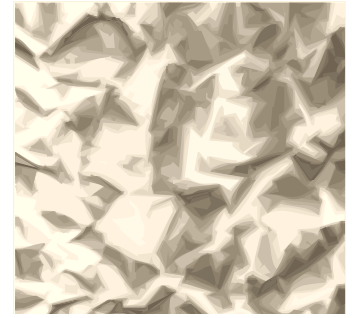
Wrinkling

What did we test for?

To evaluate the degree of item wrinkling caused by the action of the dryers.

Why?

Ironing is a chore. The more wrinkled your clothes are, the harder and longer this tedious job becomes. One of the benefits of using a dryer should be fewer wrinkles.



How did we test for wrinkling?

A wet 5.5 lb mixed shirt and towel load with five unwrinkled swatches was loaded into each dryer. Each dryer was tested on its Regular/Normal cycle. At cycle end a panel of assessors evaluated the degree of wrinkling of each swatch.



Swatch before test



Light iron required



Not able to be worn without ironing

What we found:

Overall the AeroSmart dryer produced the least wrinkled load at the end of a regular cycle and the Maytag Neptune produced the most wrinkled load.

On average, 67% of all swatches tested in the AeroSmart dryer required either little or no ironing at cycle end. This compares to just 16% of all swatches tested in the Maytag Neptune and 37% of all swatches tested in the GE Harmony.

The majority of swatches tested in the Maytag Neptune at cycle end were not wearable - definitely needed an iron. (84%).



Tangling

What did we test for?

To evaluate the degree of clothes tangling caused by the action of the Regular/Normal cycle.

Why?

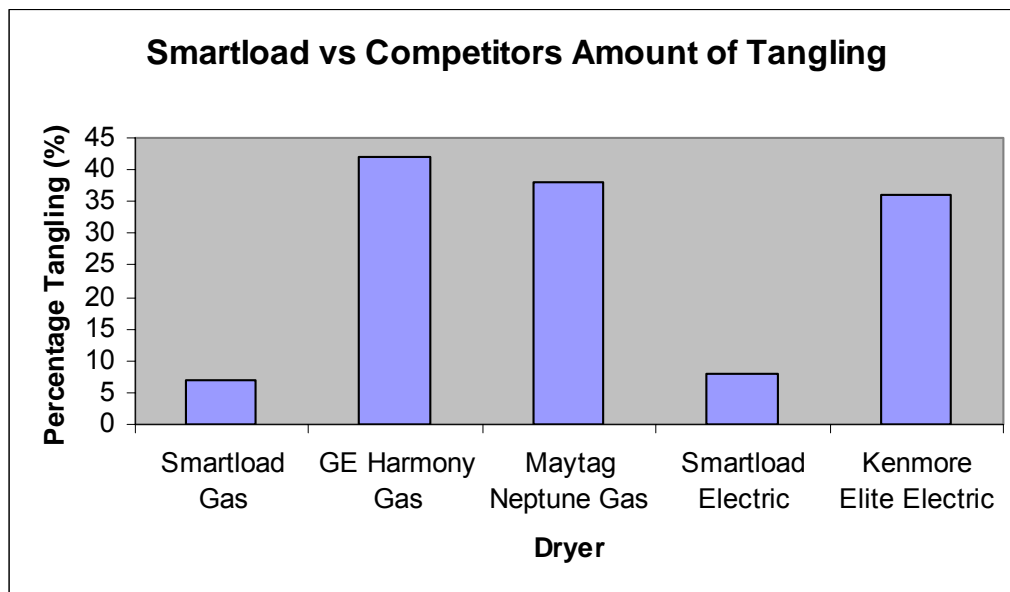
Less tangling and twisting of items means improved clothes care. This generally means that items require less ironing and are less susceptible to distortion of shape.

How did we test for tangling?

We rinsed and spun long sleeved business shirts in an EcoSmart washer. The shirts were loaded in a standard configuration into each dryer on its normal cycle. The percentage of tangling was calculated at the end of the cycle.

What we found:

It was clear that the reverse action tumbling of the AeroSmart dryer resulted in less tangling and wrinkling of the shirts. The GE Harmony had the worst result with the most tangling



'Twist and Shout'

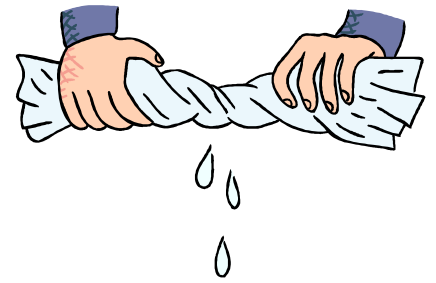
Competitor Dryers



AeroSmart



Evenness of Drying



What did we test for?

To evaluate how evenly each dryer was able to dry a load of laundry.

Why?

A good dryer dries the clothes evenly. Final Moisture content indicates average dryness but this can mean that some parts of the garment are over-dry whilst other parts are damp. This can mean that laundry needs to be redried before it can be worn or stored.

How did we test for evenness of drying?

This test aims to visually demonstrate how evenly a dryer is drying. We used a big load (11 lb). Included, in the standard load, were a number of fabric swatches that clearly showed any damp patches that remained at the end of the cycle. Each garment was 'felt' for dampness and total area of dampness on the fabric swatches was measured and calculated.



Checking for Dampness

What we found:

Fisher & Paykel AeroSmar Gas Dryer



**Very small damp patch.
2% total area damp**



No dampness



**One very
small patch
of dampness**

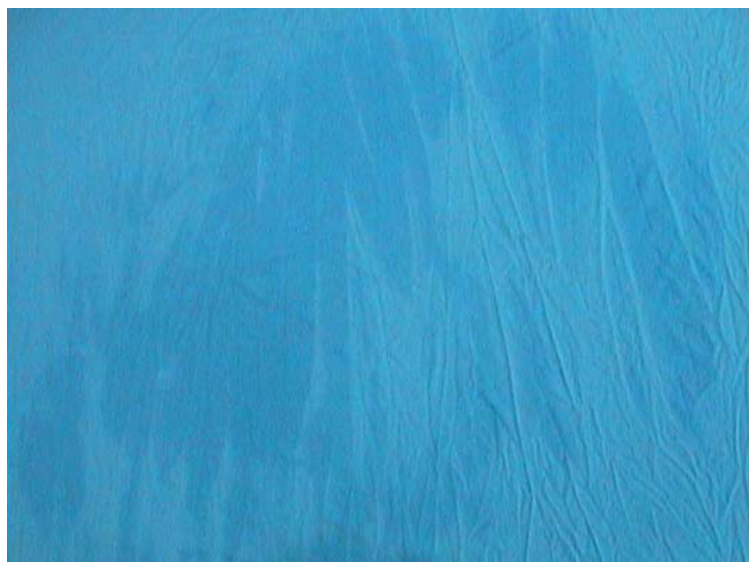
Maytag Neptune Gas



**67% of total
area damp**



**Large damp
and dry areas**



**Large damp
patches**

G E Profile Harmony Gas



75% of total area damp.



Some large areas that were very damp and some parts of swatch very dry



Large damp patches

Aerosmart Electric



**Small
patches of
dampness**



**Small damp
patch . 3%
of total
area damp**



**Some damp
areas**

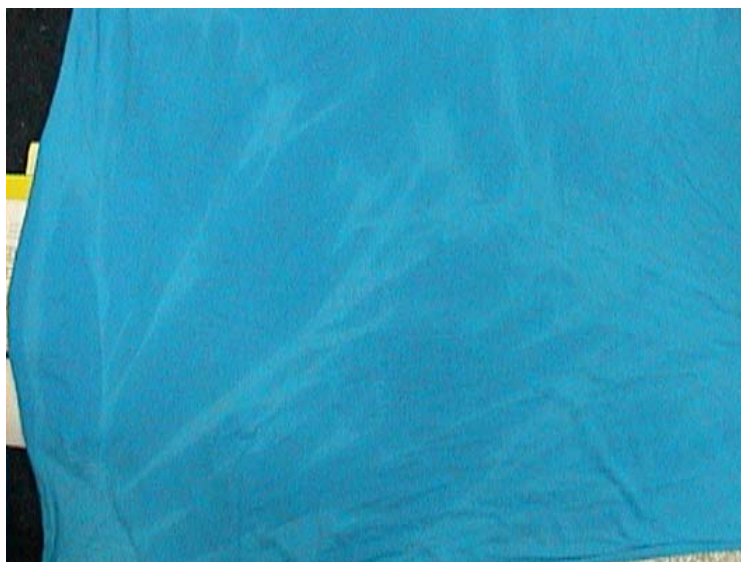
Kenmore Elite H_E3 Electric



**80% of total
area damp**



**Large areas
both very
damp and
very dry**



**Large areas
both very
damp and
very dry**



Evenness of Drying Summary

Total overall dampness score

Fisher & Paykel AeroSmart Gas

G E Harmony Gas

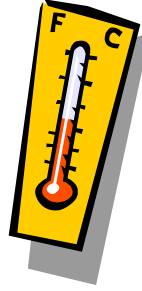
Maytag Neptune Gas

Aerosmart™ Electric

Kenmore Elite Electric

As you can see there is a dramatic difference between Aerosmart and the other dryers tested. While garments and swatches taken from the Kenmore Elite were very damp in some areas, other areas felt very warm. Similarly the Maytag Neptune and the GE Harmony dried some items whilst others had damp patches. Both the Aerosmart Electric and the AeroSmart™ Gas dryers dried the load the most evenly.

Heat vs Clothes Care



Delicates

What did we test for?

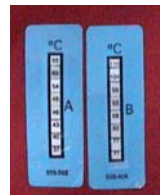
The amount of heat garments were exposed to during the Delicate cycle.

Why?

Delicate clothes can often be damaged when exposed to high temperatures. It is recommended that clothing temperature does not exceed 140°F (60°C).

How did we test how well each dryer cared for delicate items?

We looked specifically at the amount of heat garments were exposed to during the Delicate cycle by placing temperature sensitive “thermolabels” on various delicate garments. We used a small delicate load, as these are more commonly dried than a larger load of delicates.



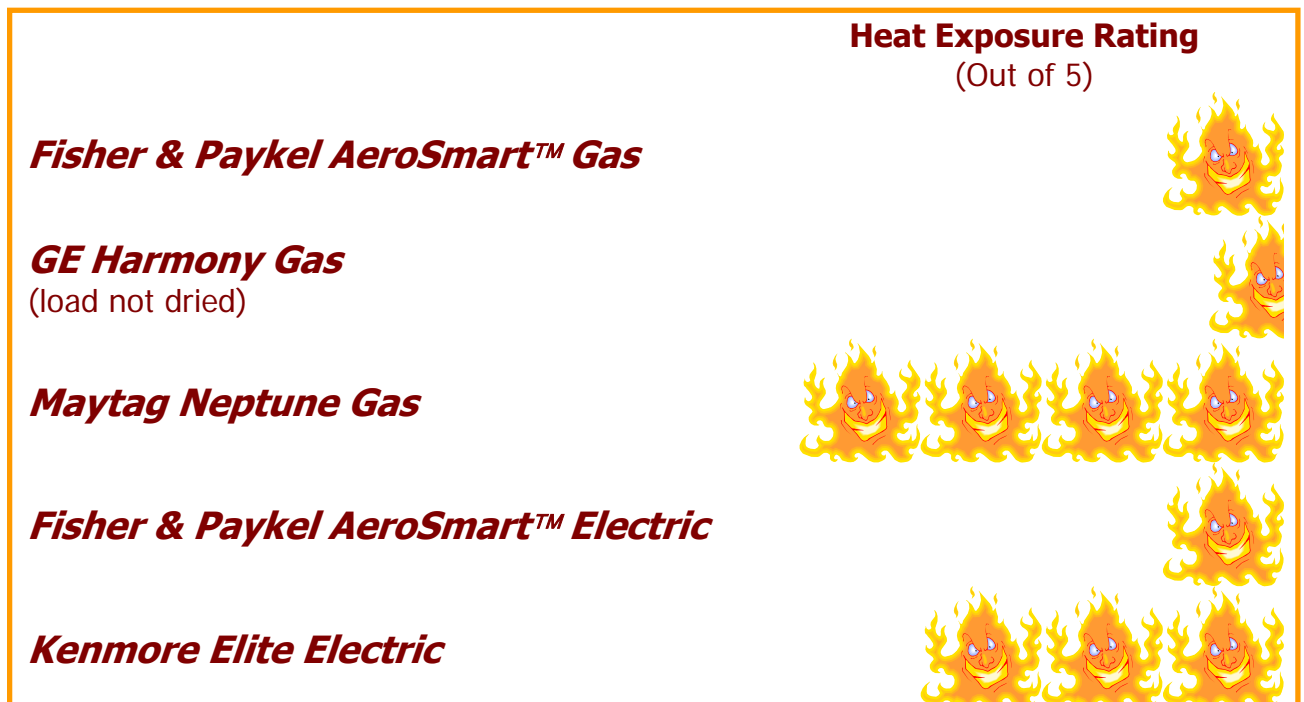
Thermolabel

What we found:

All dryers were capable of drying the small delicate load except for one dryer. Of the 10 items in the load, on average the GE Harmony dried only 2.

Although both the Kenmore Elite Electric and the Maytag Neptune Gas dried the load, they both exceeded the 140°F (60°C) maximum recommended temperature.

The only product able to dry the delicate load efficiently, without exceeding the maximum temperature was the AeroSmart Dryer.



Permanent Press Care

What did we test for?

We tested how well each dryer was able to dry a load of laundry using the Permanent Press cycle.

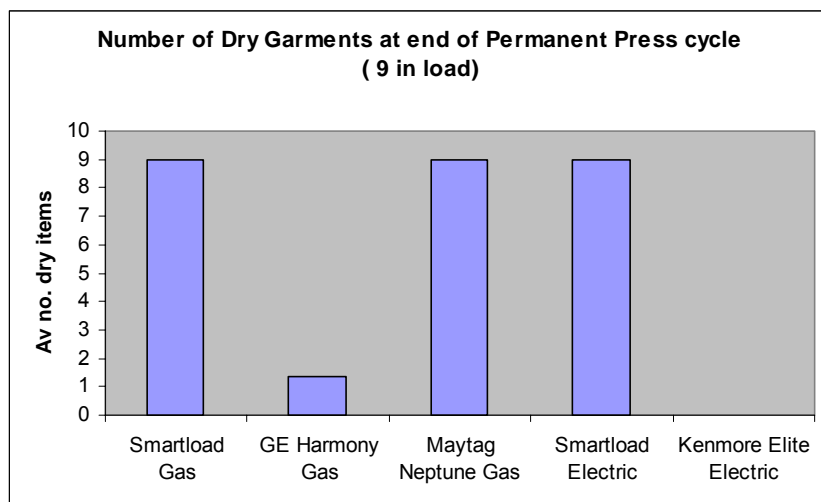
Why test?

The Permanent Press cycle is used for clothes that traditionally require ironing. A good Permanent Press cycle results in clothes that are not only dry, but also require little or no ironing. It is also important to avoid high temperatures, which can damage synthetic fibres.

How did we test how each dryer cared for the load in the Permanent Press cycle?

From our field research we made up a 5.5 lb load consisting of garments commonly dried using the Permanent Press cycle. The load was wet and thermolabels were attached to various items in the load, which was then loaded into each dryer.

What we found:



Drying

We found that neither the Kenmore Elite nor the GE Harmony dried the load well. None of the garments in the Kenmore Elite load were considered dry. The GE Harmony achieved more acceptable average moisture contents than the Kenmore Elite, however many items still had damp patches. Our assessors believed these items would need to be redried.

Temperature

Although the Maytag Neptune was able to dry the Permanent Press load to an acceptable dryness level, the temperatures that the clothes reached were the highest of all the loads tested. This was deemed unacceptable for Permanent Press garments. The energy consumption for the Maytag Neptune Gas was 44% more than that of the AeroSmart Gas.

Wrinkles

Of the cycles completed the AeroSmart consistently delivered the least wrinkled garments.



Few wrinkles from the AeroSmart™ dryer

The AeroSmart dryer Wrinkle Free option is automatically selected for the Permanent Press cycle. The only other dryer where this is the case is the Kenmore Elite Electric.

The GE Harmony Gas extended tumble option will operate only if selected and provides only 20 minutes of no heat tumbling. The same applies to the Maytag Neptune Gas Press Care option.

AeroSmart's Wrinkle Free option can be used in conjunction with any of the dryer cycles providing wrinkle protection for approximately 24 hours, while using minimal power. The benefit is that, if you're unable to unload the dryer immediately at cycle end, AeroSmart's Wrinkle Free option minimizes wrinkling.

Overall, the AeroSmart™ dryers were able to dry the load of Permanent Press type garments, without exceeding safe clothes care temperatures and at the same time minimising wrinkles.

Speed vs Clothes Care

What did we test for?

To evaluate how well the Regular cycle of each dryer cared for clothes.

Why?

It is possible to dry a load very fast but high temperatures, which can contribute to fast cycle times, also can cause clothes damage eg. shrinkage.

How did we test?

We tested a 3 lb and 6.6 lb regular mixed loads on the Regular cycle of each dryer, to evaluate how well each dryer cared for the laundry. Each load was wet and spun in an Ecosmart washer. A thermolabel was placed on a shirt in each load to ascertain the maximum temperature the load reached during the dryer cycle. Final Moisture content, cycle time, energy consumption, maximum garment temperature and observations of how dry each item felt were recorded.

What we found:

Average Cycle Time (mins)	AeroSmart Gas	GE Harmony Gas	Maytag Neptune Gas	AeroSmart Electric	Kenmore Elite Electric
3lb Regular	35	29	34	30	16
6.6lb Regular	47	34	44	44	29

3 lb Load

With this size load the cycle times are reasonably similar. The Kenmore Elite Electric was the quickest, but failed to adequately dry the load.

Next fastest were the GE Harmony Gas and the Maytag Neptune Gas. But, even a long cooldown by the Maytag Neptune didn't mask the fact that the garments in these loads were exposed to unacceptably high temperatures.

AeroSmart was able to dry the loads using safe temperatures, reducing the risk of clothes damage. It also produced a load that was neither tangled nor wrinkled.

Both the Maytag Neptune and the GE Harmony used more energy to dry the load than the AeroSmart dryers. The GE Harmony Gas used 48% more energy and the Maytag Neptune Gas used 18% more energy than AeroSmart. Gas dryer.



By using a AeroSmart Gas dryer compared to using a Maytag Neptune Gas dryer, you could **wash for free** in your Ecosmart washer for up to **4 months** of the year.

6.6 lb Load

The Kenmore Elite again failed to adequately dry the load. It was considered that this load would need to be redried.

Although the GE Harmony Gas dried the 6.6 lb load the quickest, it used the highest heats to achieve this fast cycle.
– the temperature of clothes reached 199°F (93°C).

The one direction tumble of the GE Harmony Gas resulted in obvious balling or items within the load.



Balled garments from 6.6 lb load dried in GE Harmony



The AeroSmart cycle dries at a safe clothes care temperature and uses less energy than its competitors - 29% less than GE Harmony and 21% less than the Maytag Neptune. The benefit of drying at lower temperature is that the dryer is less likely to damage heat sensitive items that may be in the mixed load.

Although the competitors are able to dry quicker they are sacrificing clothes care for speed.

While speed might be good you don't want to dry fast to the detriment of the garments.

AeroSmart's slightly longer cycles are drying the load well at safe temperatures with less tangles or balling when the load is removed from dryer.

From these results it is clear that some of the benefits of using AeroSmart are:

- not having to redry large loads.
- better clothes care through use of lower, fabric safe temperatures which means less shrinkage.
- less tangling and balling because of AeroSmart's dual direction tumble.
- less energy used to complete a cycle.

Additional Observations:

- In the event of an interruption of the power supply to the dryer AeroSmart™ is the only dryer tested that will continue the current cycle when power is restored **without** the consumer needing to press any button or reset the dryer. So if there was a power cut while the dryer unattended the only indication of having had a power cut would be your bedside alarm clock flashing.
- GE Harmony Gas has a large glass front panel door. Whilst the idea of being able to see your load drying has appeal, the reality is that the consumer is able to watch as the load becomes more and more tangled.
- The GE Harmony glass door, within a short period of time showed evidence of scratches from items in test loads.
- Large loads in a front loading dryer can pop the dryer open mid-cycle, which would result in a wet load when the consumer returned for the end of the cycle.
- The Maytag Neptune lint filter came out with a large load as it was removed from the dryer. This meant lint was redeposited onto the load and the load had to be rewashed and dried.
- The AeroSmart electronic push button panel is easier to use than the rotary dial of the Maytag Neptune.
- With the GE Harmony interface options are quite hidden. The user needs to make more choices and it would take longer to become familiar with the dryer operation.
- Both the Kenmore Elite and the Maytag Neptune panels required the user has to press very firmly to make the Start button function.

Summary

AeroSmart

- ✓ Best Ergonomics
- ✓ Easiest and cleanest lint disposal system to use
- ✓ Least Wrinkling
- ✓ Least Tangling
- ✓ Most even drying
- ✓ Dries at safe temperatures
- ✓ Longest wrinkle protection – up to 24 hours
- ✓ Soft touch buttons
- ✓ Energy efficient
- ✗ Longest Cycle Time

GE Harmony

- ✓ Fast cycle times
- ✓ Soft touch buttons
- ✓ Large visual screen
- ✗ Poor Ergonomics
- ✗ Worst Tangling
- ✗ Used most energy because it is running two motors
- ✗ Interface takes time to become familiar

Maytag Neptune

- ✗ Poor Ergonomics
- ✗ Worst Wrinkling
- ✗ Used long cool-down to try and hide unsafe temperatures used for drying clothes
- ✗ Used lots of energy to dry
- ✗ Start button hard to press
- ✗ Rotary dial

Kenmore Elite

- ✗ Wrinkle protection for an extended period
- ✗ Poor Ergonomics
- ✗ Failed to dry regular loads adequately
- ✗ Most unevenly dried items – very damp patches and very warm patches

Electronic Control

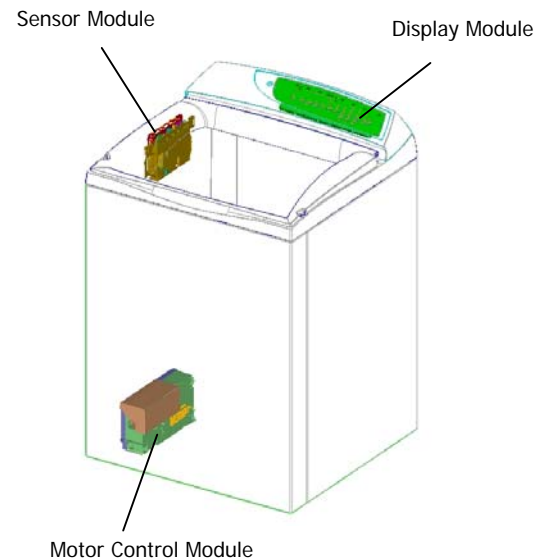
There are three separate electronic controls: the motor control module, the sensor module and the display module.

The **motor control module** receives commands from the sensor module for operating the heat source and controlling the motor's speed and direction.

The **sensor module** has overall control of the dryer. It controls the lid lock and drum door actuator, as well as measuring the dampness of the clothes via the sensor bars.

An optically isolated serial communications port links the motor control and the sensor module.

The third electrical communication is the **display module**. It is the interface that passes user settings to the sensor module and displays information in the form of LEDs and text on the display screen.



EPROM: The EPROM stores cycle and history data in the Sensor Module. This data is used for diagnosing dryer faults. It's like the black box recorder that planes have, its permanent memory.

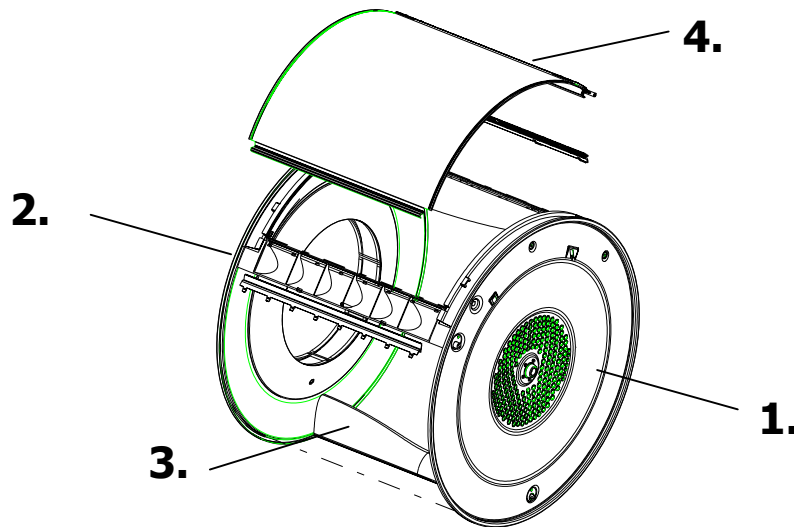
There is a special tool used for servicing the dryer – Smart-Tool. This device can be used to receive this EPROM information to help servicing.

There are three things EPROM stores:

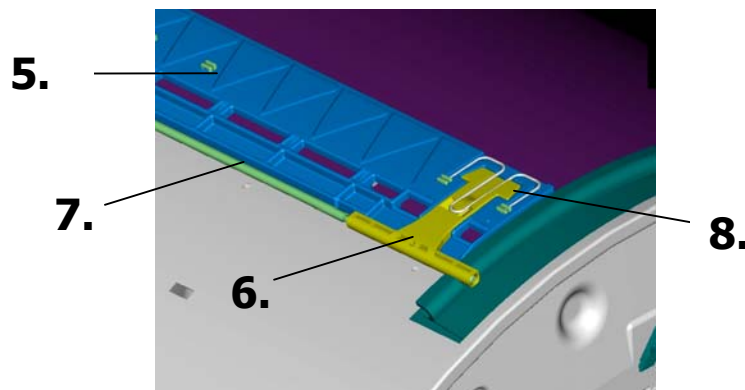
- 1) It records cycle and history data.
- 2) Stores the serial number, model number, time of manufacture etc for servicing.
- 3) Saves critical parameters when the power fails, so when the power is restored it can carry on the cycle.

Drum Parts

1. **Drum Inlet End:** allows inlet air to pass through, this is how air enters the drum. It also houses the inlet central bearing assembly, about which the drum rotates.
2. **Drum End Outlet:** provides the route for air to exit the drum as well as securing the lint filter. The outer edge has dimples, which provide positioning information and data on speed. The drum end has seven outlet bearing pads that run on a flange to help with drum rotation.
3. **Vanes:** encourage clothes to tumble during the drying cycle.
4. **Drum Door:** slides back along grooves in the bridge to provide access into the drum.



5. **Bracket Door:** secures and seals the drum in the closed position and houses components for latching the door.
6. **Arm Hinge:** Part of the door assembly, which is contacted by the grabber door for opening and closing the door. It also latches the door closed over the end of the track.
7. **Locking Bar:** Attached to its ends are the arm hinges. Its function is to hold these hinges in the correct orientation.
8. **Spring Hinge:** Springs the arm hinge down to ensure latching when the door is closed.



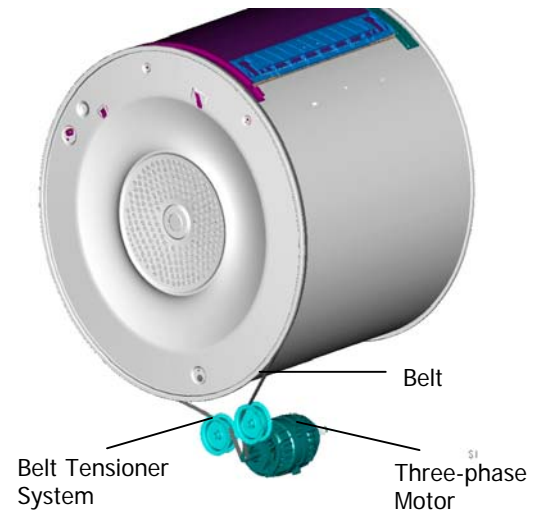
There is also a **Scraper Door Drum** that prevents clothes from being drawn into the gap between the drum and the door when the door is opening, and a **Key Bracket** that prevents the door from closing when the clothes are protruding.

Drum Control

The drum is rotated by a belt and pulley system to a three-phase induction motor, this is controlled by the Motor Control Module.

When tumble drying, the drum is tumbled at 47 rpm and at 5 rpm during opening and closing, other speeds are used as required.

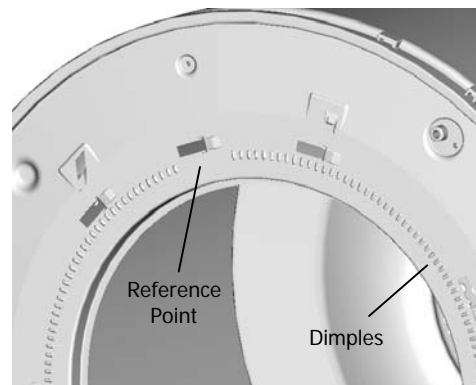
The drum's position and speed is sensed through the drum tacho signal, which comes via the sensor module.



How does the drum tacho sense the position and speed of the drum?

The drum has a number of dimples that have been pressed at the drum outlet which are spaced every 2 degrees of angle around the drum end. There is a 15-degree "gap" to provide a reference for absolute position, which is required for the opening and closing of the drum door.

A beam of light is directed by a lens at the arch of the drum dimples and the amount of light that bounces back is sensed. When the light hits the smooth surface between the dimples it reflects much of the light back to the light sensor, when a dimple is hit the light is deflected away and in this way the position of the drum is monitored. The 15 degree "gap" which can be located when the drum is moving at a known speed provides the required absolute position of the drum.

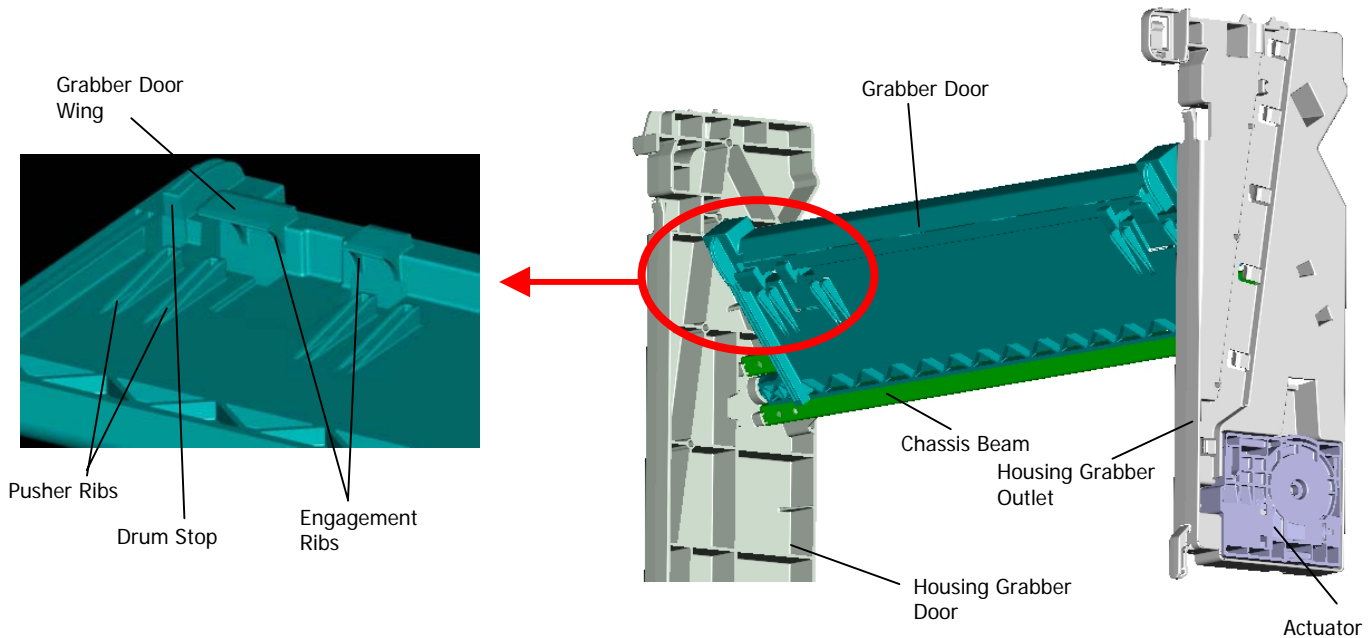


The drum's speed and position are critical for the speed control of the drum motor by the Motor Control Module and also for the Sensor Module for the operation of the drum door opening and closing sequence.

Sub Deck Assembly

Its basic function is to open and close the drum door.

The Subdeck is stationary and is mounted onto the chassis panel.



DRUM DIRECTIONS

What is the drum closed direction?

If you stand in front of the dryer, the closing direction is when the drum rotates towards you.

When the dryer closes it rotates in this direction. When drying the drum rotates in this direction for 4 minutes.

What is the open position?

If you stand in front of the dryer the open direction is when the drum moves away from you.

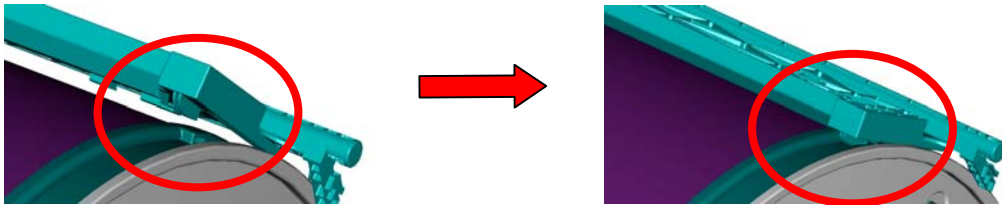
When the dryer opens it turns in this direction. When the dryer reverses for 40 seconds (to prevent tangling) it rotates in the open position.

Drum Opening and Closing

How does AeroSmart™ open the drum door?

Once the position of the drum is known (Refer to Drum Control page 47) the door opening sequence can begin.

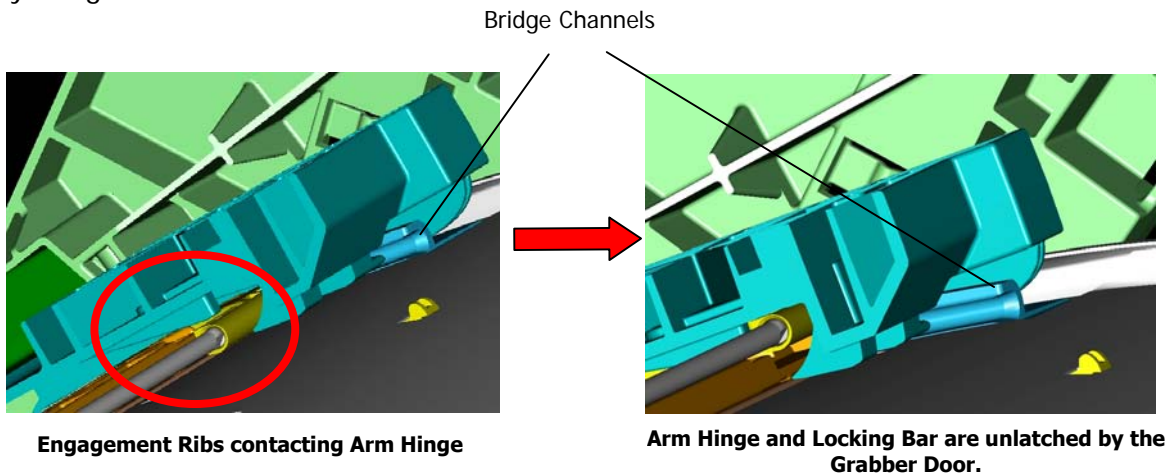
Firstly the drum slows down to the drum opening speed (approximately 5rpm). The grabber door is then lowered down against the drum wrapper by the actuator.



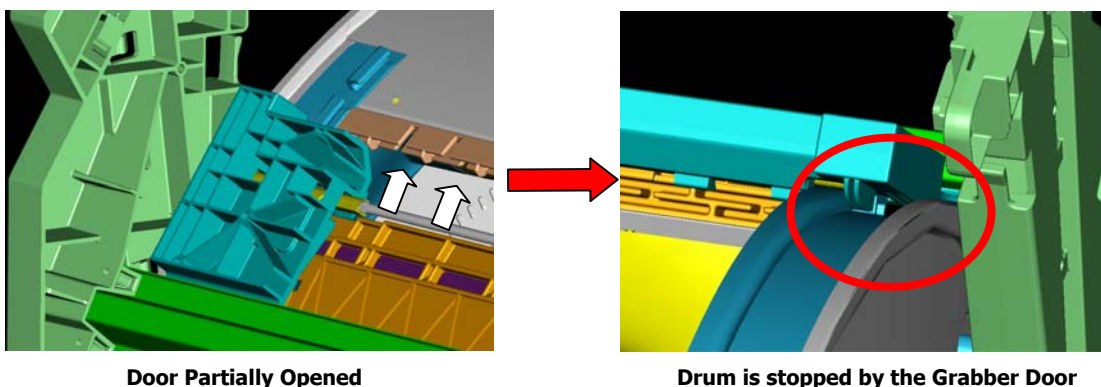
Grabber Door is lowered against the Wrapper

As the bridges approach the lowered grabber door, wings on each side of the grabber door enter the bridge channels. If the wings do not enter the channels the grabber door will be unable to open the drum door (refer to the diagram below).

As the drum continues to rotate the engagement ribs attached to the grabber door unlatch the drum door arm hinges, lifting them out of the channel slots. The arm hinges are raised by details on the grabber door to the top face of the bridge channels. The drum continues to rotate in the opening direction, while the drum door is held stationary by the grabber door.



As the drum reaches the fully opened position, details on the drum bridges hit the grabber door, causing the motor to stall and the drum rotates to stop. The drum is now in a fully opened position, where the user can load or unload garments from the dryer.

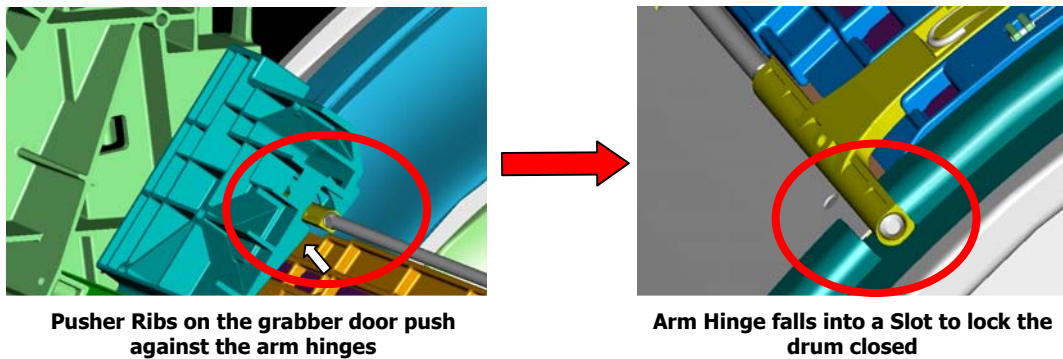


The dryer electronics can determine whether the drum has reached the correct position by way of the optical sensor attached to the Sensor board, which uses the dimples on the drum end outlet to determine the drum position.

How does AeroSmart™ close the drum door?

To close the drum door the drum rotates in the closing direction while the drum door is held stationary by the grabber door. During this sequence the arm hinges are pressed against the pusher ribs on the grabber door. As the drum rotates at approximately 5rpm the drum door slides shut.

When the arm hinges reach the channel slots they drop down and latch in these slots, due to the spring loading on the arm hinges (generated by the spring arm hinge).



The drum rotates through another few degrees at which point the grabber door wings exit the bridge channels and the grabber door is raised by the actuator. At this point the drum can speed up to the standard operating speed of 47rpm.

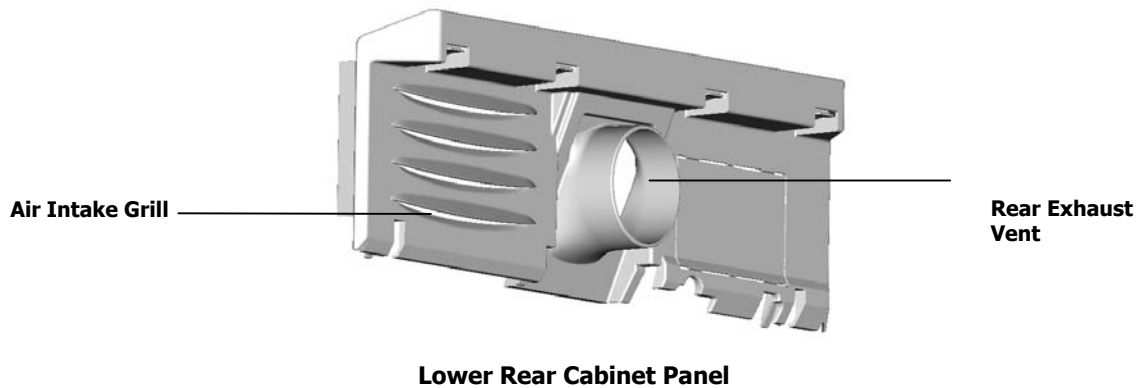
How does the drum know if something is in the way?

Inserted into the dryer is a mechanical interlock which prohibits the drum door from latching closed if garments get caught in the drum opening. With the door unable to close, the drum will stall, which will be sensed by the motor control module and corrective action will occur.

If the motor stalls due to something getting in the way of the drum door a “Clothes Jammed” fault will be internally flagged. The drum will reverse and open the door again. It will try three times and if it is still unable to close the door, a User Warning will be displayed to let the user know to push their clothes away from the opening.

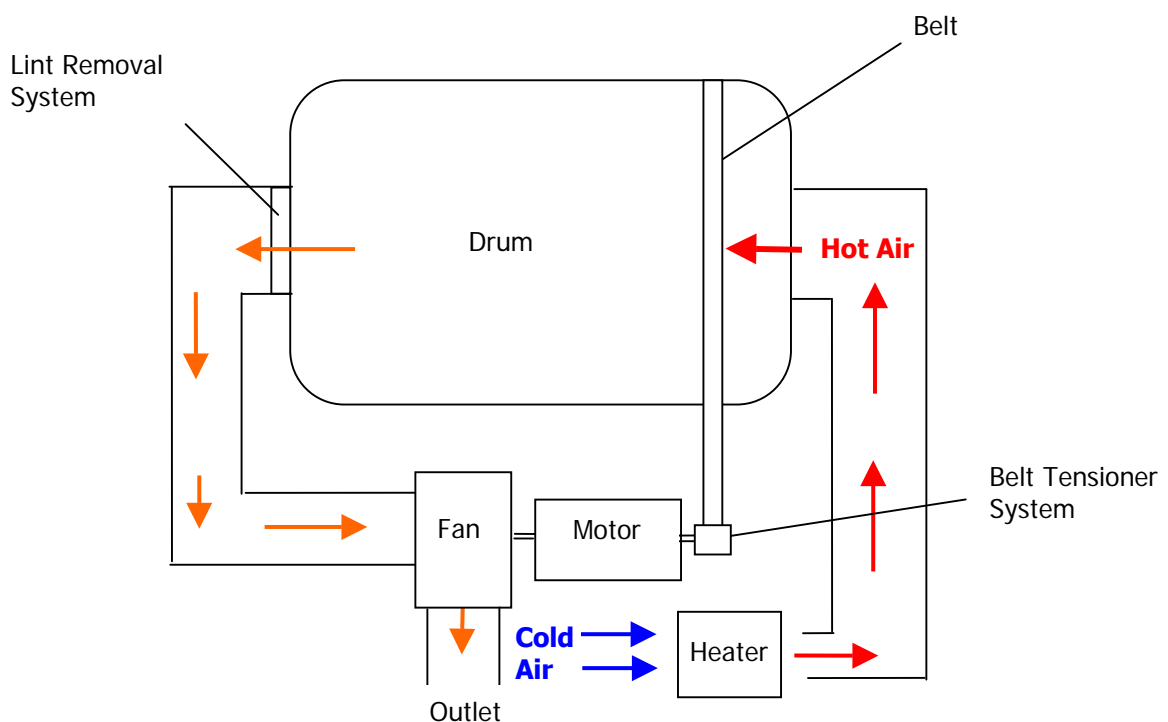
Airflow

An intake grill at the bottom rear of the cabinet provides an entry point for airflow. Additional air is drawn in at the front of the cabinet under the front panel.



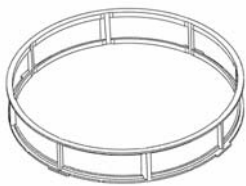
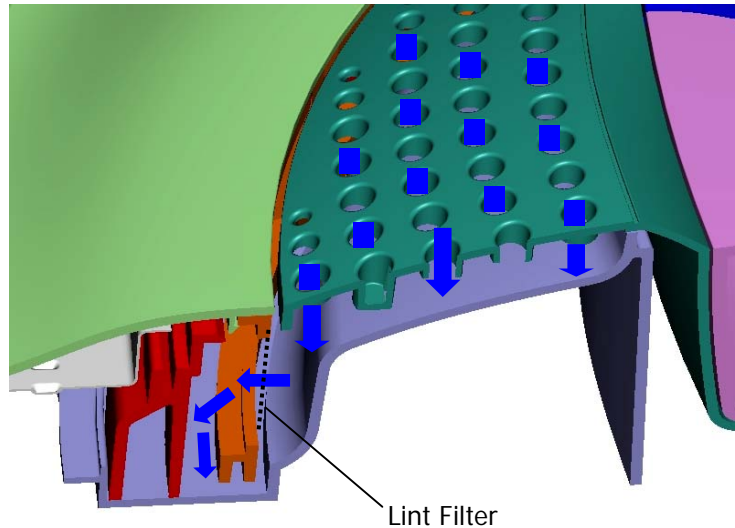
A fan on the exhaust side of the drum draws the air over the heating elements/gas burner located in a combustion chamber, through an inlet duct and into the drum. Air flows in through the inlet end of the drum. The holes in this end are formed so they are recessed and there are no sharp edges to ensure there is no damage to clothes as they rub against it.

The air exits the drum through a self-cleaning lint filter in the drum outlet duct. It then passes through the fan housing and out the rear exhaust vent situated at the bottom rear of the cabinet.



Lint Removal System

Lint laden air passes through the small holes in the outlet end of the drum. (The small holes around the lint bucket). The lint removal system is directly behind these holes. As this air moves through the holes it is forced through the lint filter, the fan then sucks the air down through the duct and out the back of the dryer.

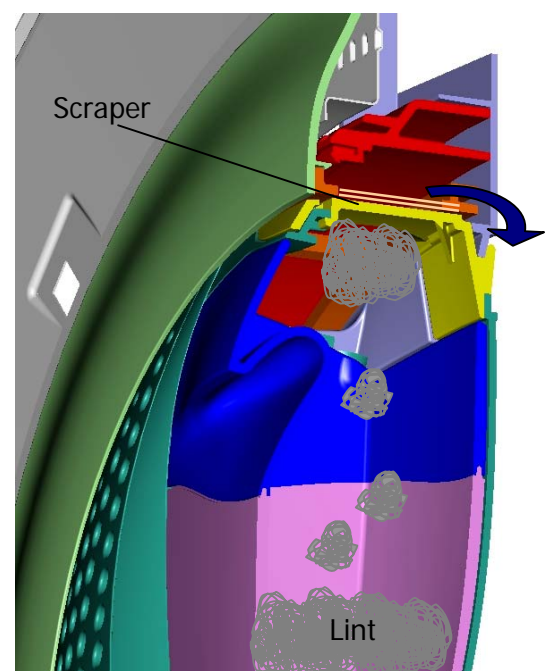


The lint filter in the AeroSmart™ dryer is circular and is positioned next to the drum. When the drum rotates the lint filter rotates with it. The filter is made of very fine 200-micron mesh. By using such a fine mesh we can catch more lint when it flows through the lint removal system. With less lint flowing into the ducting there is less chance of lint clogging up this area.

There is a scraper situated on the top of the lint collecting housing which the filter moves past. As lint on the filter builds up the lint begins to touch the scraper, and is automatically scraped off. Because the scraper is directly above the lint bucket it falls straight in.

The mesh on the lint filter gets cleaned 2 to 3 times a cycle, so the airflow doesn't deteriorate as the cycle progresses.

The Lint Removal System is self-clearing. If the lint bucket overflows due to the user not emptying it the AeroSmart™ dryer can clear itself. The user just needs to empty the bucket and run the dryer on a cycle for roughly 20 minutes, the dryer will free all the trapped lint and will re-deposit it back into the lint bucket.



Heat

Heat is supplied either by a gas burner or electric elements.

Electric Elements

In the electric heater models, the heater housing is fitted with two elements that supply about 5kW of heat when both are on. There is a 3.6kW and a 1.4kW element that are used at various times depending on the cycle chosen and the drum/fan direction. The elements have been designed to achieve maximum heat transfer to the inlet airflow.

The heater is only switched on when the drum is up to speed. Because of the length of time it takes for the element to cool down after switching off, the larger element in the electric model is switched off a few seconds before stopping to reverse. This is to prevent excessive heat entering the drum.

There are two Auto Reset Thermostats that operate at 176 °F (80 °C) and one Manual Safety Thermostat that operates at 212 °F (100 °C).

Auto Reset Thermostats act to control inlet air temperature to the drum. If the airflow is less than 230 cubic feet per minute (60 litres a second), they will activate and prevent the air from getting too hot. They are located at different positions to sense for different conditions.

Manual Reset Thermostat only activates if there has been a failure. It's a backup if the auto reset doesn't work.

Auto reset thermostats are connected to the relays in the control module. They turn the elements off by removing the power from the relays.

The manual reset thermostat is connected to the common phase/line and disconnects the main power supply, a more direct approach.

The element grill and wiring insulators are designed to meet UL safety enclosure standards.

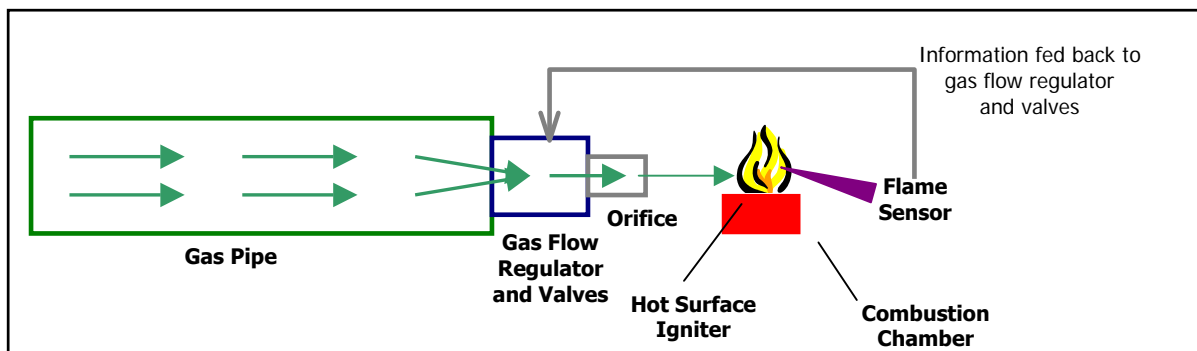
Gas Burner



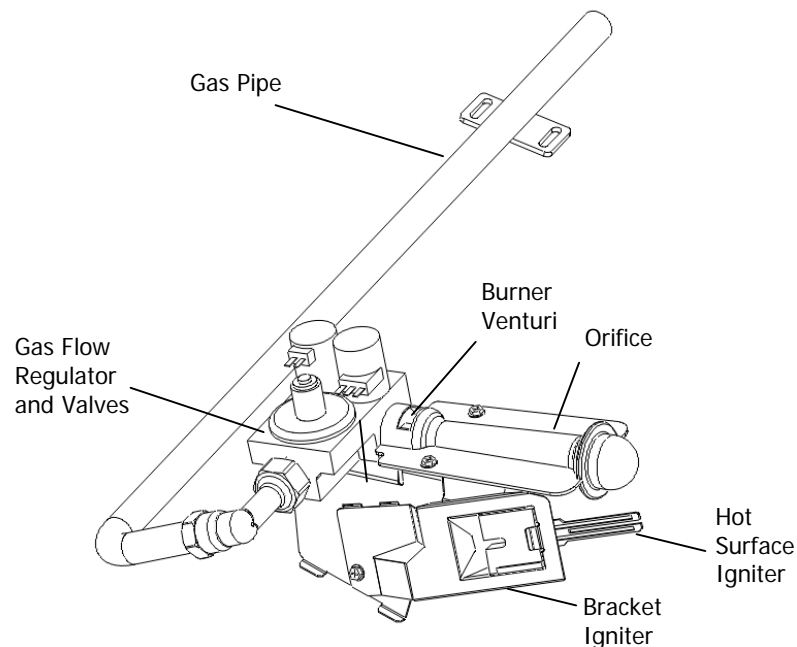
For the gas model, a gas burner is used to provide the heat. This is turned on for lower duty times for the Permanent Press and Delicate cycles, to apply similar heating as the electric model. The heater is only switched on when the drum is up to speed.

The gas heater has a Venturi type gas burner system.

The gas flows through the gas pipe, through the gas flow regulator and the valves to the orifice, which lets the gas flow into the burner.



The gas is ignited by a hot surface igniter. The flame sensor then senses the flame. All these items are connected in a central circuit with the gas valves, which ensures the gas burner operates safely.



Gas Burner Assembly

As long as the flame sensor is hot the gas will continue to flow. If the flame goes out the sensor will switch off the gas supply and the ignition sequence will begin again.

The thermostats operate in the same way as the electric elements, although there is one Auto Reset Thermostat and one Manual Thermostat that operates at 293°F (145°C).

Inside the combustion chamber is a steel plate. This allows cool air to flow between the flame and the top of the combustion chamber, which keeps the outside surface of the chamber cool. It also acts to spread the flame to get more even temperatures in the inlet airflow.

The flame should be a nice blue color when burning correctly, if it is yellow it indicates incomplete combustion. This occurs if it is not getting enough air, check the airflow isn't blocked.

Fan

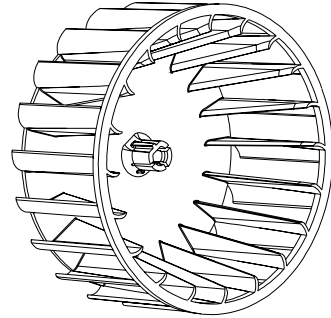
The fan moves the air through the heater, drum and exhaust ducting.

It is a centrifugal fan, which produces relatively high flow for its size and speed.

The fan is mounted onto the motor shaft.

The key benefit of our system is that we are able to run the fan faster than conventional machines (we can run at 2300rpm whereas they can only run at ~1700rpm).

Running at 2300rpm means extra airflow. This is up to 10% more airflow than our competitors.



AeroSmart™ rotates the drum in both directions. We have designed the fan to produce maximum airflow when the drum is rotating in the closed direction. It travels in this direction for 4 minutes.

In the open direction it has half the airflow. This is why when we reverse, we only use half the heat, as we don't want to damage clothes in the drum. It travels in this direction for 40 seconds.

More Airflow = More Power.

This means we don't have to dry with high temperatures. We can dry with lower temperatures for better clothes care and still achieve the same cycle time as conventional dryers.

In an average installation we would expect the airflow out the exhaust to be 230 cubic feet per minute (60 liters per second). An average installation for competitors is around 106 cubic feet per minute (50 liters per second).

The length of the ducting, the number of corners and the type of ducting affects the rate of airflow. Crushed ducting behind the dryer or blocked ducting (if the ducting is old) can also affect airflow.

What will happen if the airflow is blocked?

Thermostats are fitted to the heater housing which limit the temperature going into the clothes load in the drum. If the airflow is heavily restricted from the exhaust duct, possibly by an over full lint collector or a blocked or kinked exhaust duct, it will cause the heater to rise in temperature and the thermostats will switch off the heat. After the heater cools down the thermostat will again switch the heater on. If the airflow restriction remains the Dryer will continue to switch off and on the heat and take a long time to dry the load. The Sensor Module monitors the activity of the thermostat and when a continuous switching on and off occurs it sets the air flow restriction user warning until the drying cycle is complete. It is up to the user to clear the restriction.

Motor

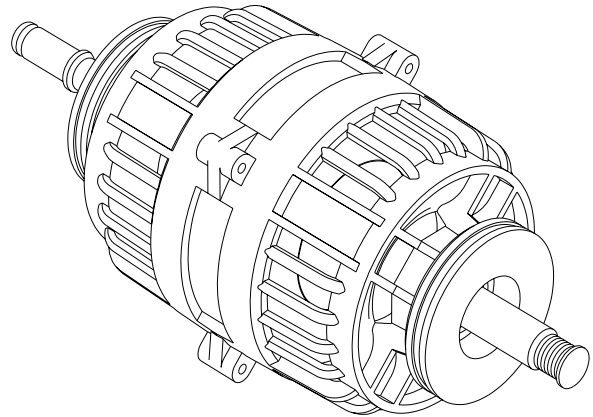
Definition of the motor:

The AeroSmart™ motor is a 250W four pole three-phase motor with a cast aluminium end shield construction.

It has the same torque in forward and reverse rotations.

What does the motor do?

It powers the fan and rotates the drum (via the drive-belt).



How is our motor different?

The AeroSmart™ dryer has a three-phase motor. It varies the speed by changing the frequency of the motor current (AC). It doesn't have to use the drum speed feedback at door opening and closing speed. We only need to use a simple belt tensioner assembly to connect the motor to the drum.

The motor drives both the fan and the drum. At one end of the motor is a fan and at the other end is a pulley. A rubber belt sits around the pulley and the other end wraps around the drum (refer to Airflow for a diagram page 51) The motor acts as a drive system between the two. When the drum rotates at 47 rpm the fan is spinning at 2300 rpm.

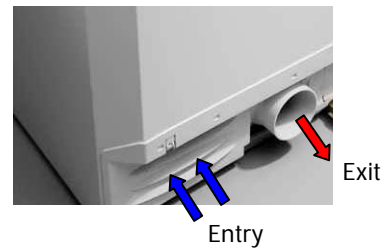
Conventional single-phase motors require a capacitor to start. This supplies the phase difference to drive the motor. AeroSmart's three-phase motor creates different frequencies with the electronics. The speed isn't determined by the frequency of the power supply, so we can drive it at any speed we want.

Drum Speed During Tumble	47 rpm
Motor Speed During Tumble	2300 rpm
Motor Power During Tumble	250 V Electric, 120 V Gas
Motor Torque at Tumble Speed	1.0 Nm
Motor Torque at Door Closing Speed	1.8 Nm
Airflow with Average Exhaust Duct Restriction	230 CMF (60 l/s)
Temperature Rise of Motor	122 °F (50 °C)
Drum Inlet Temperature (max)	329 °F (165 °C)

Dryer Construction

Grill

The grill at the back of the product has two main functions. The first is to provide slots for the incoming air; the second is to provide an exit point for the hot air.



Wrapper

AeroSmart's wrapper (cabinet) is made from the same material as the washer – galvanised pre-painted steel. The wrapper is made in two parts - cabinet front and cabinet rear. The cabinet front covers the front of the product and wraps slightly round the sides. The cabinet rear wraps around both the back of the product and the sides. This allows the product to be serviced from the front and means the gas supply and ducting doesn't have to be disconnected for servicing.

User Interface/Display

The new soft touch display is a sleek, minimalist design, with a **dot matrix LCD display screen** acting as the information hub of the dryer. Aerosmart has the most wash cycles and options of any Fisher & Paykel dryer yet. It features a multi-layer menu structure.

The new dot matrix screen allows us to present information in a simple, clear way, as the user needs it. While simple interaction is important, we are also able to include extended functionality that is easy to interact with. People can access the information they want, when they want it and in the language they want.



This technology gives us great advantages in terms of usability, consistency and flexibility.

It's about simple tasks and decisions

We have based the display logic on the simple decisions consumers make as they use the product. The focus is on the user and their task, rather than the technical workings of the machine.

The depth of information and customization caters for different types of users:

1st level = simple choices

2nd level = wash option selection, more technical

3rd level = machine settings, wash option customization, most technical

Only need to go as far as the users feel comfortable

We have created our own unique F&P logic for the display interface, drawing our inspiration from many sources to ensure that the logic that we created did not conflict with the logic that people have become familiar with in other products.

Share some of the Fisher & Paykel knowledge.

We can share some of that knowledge with consumers by offering simple solutions to the tasks they are performing. We can also provide information that will inform their understanding of the products functionality through the display. This helps them to get the most out of the product.

Understanding and confidence in technology

We have utilized the interface to inform the user of machines performance and progress – enabling greater understanding and confidence in the functionality and technology, particularly for auto sensing phases.

Interface elements – Consistency and Flexibility

This new style of accessing information will become consistent across the product family. All future products will use the same language, style, format and information structure including menu, shortcuts and settings. The consistent application of icons and functionality builds up an 'F&P language'. Commonality also provides some advantages in shared mechanical and software development, components and manufacture, as well as familiarity for the user.

Using the Interface

When you first turn Aerosmart on, the main drying cycles are displayed. Highlight the chosen drying cycle using the SCROLL keys and press SELECT.



The drying cycle options will then be displayed for the chosen cycle. Drying options can be easily modified by using the scroll keys to select the appropriate option, and pressing the SELECT key.



Once START/PAUSE has been selected and the cycle started, animations appear on the screen demonstrating what function is being performed, along with ongoing information regarding the chosen drying options and time remaining.



Topdeck

The topdeck has similar styling to the washer topdeck. It has been specifically designed to give a wide mouth opening to provide easy access into the drum as well as to improve viewing capacity. It also has two plastic brackets on the underside of the topdeck to help provide strength and rigidity to ensure it keeps its shape and doesn't flex.

Lid

The AeroSmart™ dryer lid is made from the same material as the matching washer lid. It is a co-injected composite of virgin ABS skin with a glass bead filled SAN core. It is strong, easy to clean, and non-scratching.

Lidlock

AeroSmart™ has a lock attached in the topdeck to lock the lid while the drum is rotating. It is driven by a DC solenoid and is the same design and material as the washer. When a cycle is started the lid will lock before the drum door closes. When a cycle finishes or is paused, the drum will orientate itself and stop with the drum door open, before the lid is unlocked.



Vanes

AeroSmart's vanes are not only profiled to tumble the clothes around in a circle, they have also been designed to tumble the clothes from the left hand side of the drum to the right and vice versa. The benefit of this dual tumbling action is a more evenly dried load.

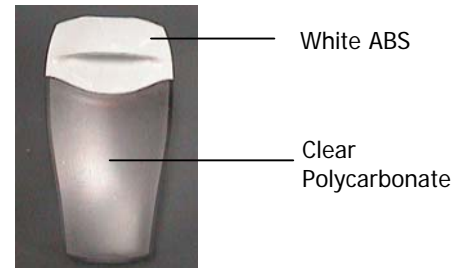
The vanes are made from polypropylene. This material was used because it is less susceptible to abrasion ie scuffing and scratching when clothes tumble the vane surface.



The remainder of the plastic parts in the drum are made from ABS. ABS is stronger and more rigid than polypropylene and makes parts that are very accurate.

Lint Bucket

The lint bucket is made from 2 parts. The lower part is clear polycarbonate, to allow the user to see the lint and how full the bucket is. The handle is made from ABS. It is shaped so it is easy to hold but doesn't protrude too far into the drum.



Drum Wrapper and Drum Ends

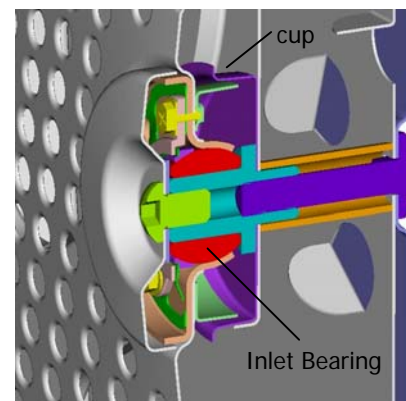
The drum wrapper and drum ends are made from stainless steel so they retain their appearance. The key benefit of using stainless steel is it won't rust, it's very durable and very hygienic.



Inlet Bearing

This bearing has to operate in high temperatures as it is in the warm inlet air stream. For this reason it is a spherical sintered bearing filled with oil and graphite. This special oil is designed to withstand heat extremes.

The bearing turns on a cylindrical shaft, which is bolted to the inlet duct. The bearing is able to move inside the housing that's attached to the drum end and enables it to cope with any misalignments.



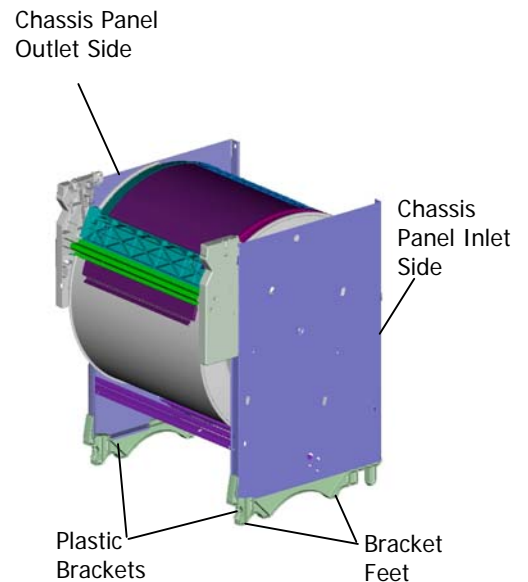
The inlet bearing supports the drum and enables it to turn on the shaft. It is also conductive so that static can flow to earth. The bearing also has a two cups that act as shields to keep any sand or grit that enters the dryer out of the bearing.

Outlet Bearing

On the outlet side we can't have a center bearing because of the lint collector. In this case there are a series of pads which are made from a special plastic. The drum flange slides on these bearing pads.

Chassis

The chassis panels are made from galvanised steel and are a major structural component of the chassis assembly. There is a panel on each end of the drum. The chassis panel on the inlet side (the panel on the right) holds the duct inlet assembly. The chassis panel outlet side (the panel on the left) holds the duct outlet assembly. There are 3 galvanised steel beams that are screwed at each end of the chassis panels. This provides the rigid framework to which the drum assembly, duct inlet assembly and the duct outlet assembly is attached.



Self Levelling Feet

The front feet are normal screw on feet like the washer. The back feet are self levelling.

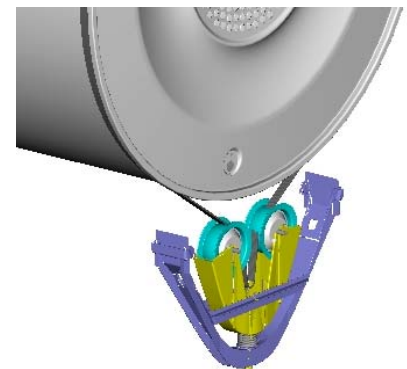
How do they work?

As one foot goes up the other goes down – It's like a level. If you adjust the front feet the back feet automatically adjust themselves. This means that the dryer always has all four feet on the ground and is evenly loaded. The dryer will never be 'racked'. If it is racked the cabinet will distort when the drum is moving. The feet are connected to each other by a stainless steel strap.

Belt Tensioner System

This system tensions the belt and ensures there is appropriate tension on the belt. Without this system to provide tension the belt would fall off the pulley.

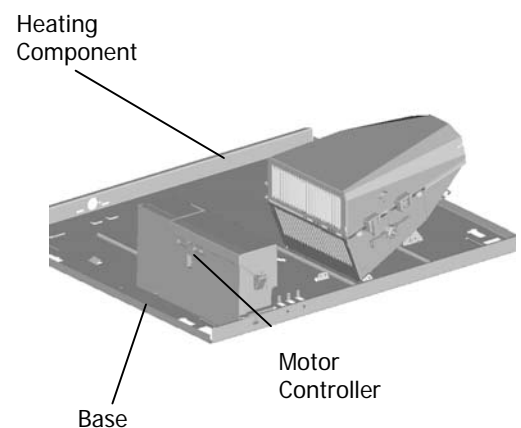
The frequency of the power generated by the electronics determines the drum speed, and because of the way the electronics drive the motor we only need a simple belt tensioner system. The diameter of the pulley is sized to produce a drum rotation speed of 47 rpm, the optimum drum rotation speed to produce effective tumbling of the clothes.



Base

The base is made from galvanised steel. It houses the motor controller and heating components (either gas or electric). These parts are either clipped or screwed on. The base also holds the feet assemblies, and provides a means for earthing the product.

There are plastic brackets made from ABS attached to the bottom of the chassis, which rest on the bracket feet and guide foot adjusting. Their function is to support the chassis panel, as well providing a means for rocking the product in and out.



Products

In Dryer Dry-Cleaning Products

Dryel and similar in dryer Dry-Cleaning products.



Dryel is an in-home dry-cleaning product for use in domestic dryers in America, produced by Procter & Gamble. There are a number of other brands of this type of product on the market. We have tested this product in the AeroSmart™ dryer and recommend that consumers follow the manufacturer's recommended instructions for its use.

Clothes are placed within a specially designed bag, with a disposable sheet that is damp with dry-cleaning fluid. The bag is then placed in the dryer. For Dryel, P&G recommends that the bag should be dried at a medium or high heat for 30 minutes (plus 5 minutes if needed). For AeroSmart™ the consumer should select **Dry & Wear or Casual (medium heat) cycle and 40 minute Time Dry**. This will give a medium heat for 30 minutes, plus a 10 minute cool down period. A section in the Use Guide has been included to provide basic instructions for this type of product.

The clothes should come out slightly damp and then should be hung to reduce wrinkles.

Dryer heat activates the moist-cleansing cloth to create a gentle steam-cleaning environment inside the Dryel Bag. The clothes are moistened with a combination of water, preservatives, a fibre protection agent and perfume.

Dryel is a specially designed fabric care system that can be used on dry clean only and special care fabrics such as wool, rayon, silk, linen, acetate and blends of these fabrics. It can also be used on hand-washable items such as cotton sweaters and other special care garments. Dryel can be used on garment accessories such as brass buttons, sequins or shoulder pads. However, Dryel should not be used on leather, velvet, suede or fur (www.dryel.com, April 2003).

Testing

During the recent USA field test installations Dryel was observed in a number of homes. There are also number of other products similar to Dryel available in the USA, sold under different brands. For this reason we tested Dryel in the laboratory to see whether In-Home-Dry-Cleaning products could be used in the AeroSmart™ dryer.

Findings

In order to follow the manufacturer's instructions as closely as possible, we recommend using a **Easy Iron or Casual (medium heat) cycle, set on 40 minute Time Dry** instead of the manufacturer's recommended 30 minutes.

If a user accidentally uses 40 minute/high heat cycle, it did not appear that this would have any adverse effects on the Dryel bag.

This product appears to pose little risk to the AeroSmart™ dryer as the dry-cleaning fluid is contained within the specially designed bag. The polypropylene (PP) used for the vanes of the drum is very chemically resistant and should not be affected by Dryel.

The lack of obvious difference between the initial and final reference cycles would lead us to conclude that the use of Dryel and the Dryel bag had no detrimental effect on the AeroSmart™ contacts and their use to determine dryness during automatic drying.

What do we say in the User Guide:

In dryer Dry-Cleaning products:	Ensure the dry-cleaning product is recommended for use in a domestic dryer. Follow the dry-cleaning product's instructions for how to prepare the load. Set the dryer to the Dry & Wear or Casual cycle, these cycles uses a medium heat. Select Time Dry for 40 minutes. At the end of the cycle remove the dry-cleaning product from the machine and continue to follow the dry-cleaning product's instructions.
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Fabric Softener Sheets

A Fabric Softener Sheet can be placed in the dryer at the start of the drying cycle. They are useful for reducing static cling as well as acting as a fabric softener.

Static cling happens when clothing continuously rubs together within the dryer. Within this dry environment, friction generates static electricity, which in turn, creates an attraction between various garments.

Softening ingredients in the fabric softener sheet are released by the heat and the tumbling motion of the dryer. These ingredients have a lubrication effect that gives fabrics similar surface characteristics. This helps prevent a build up of electrons. Fabric softener sheets control static better than traditional liquids. The lubricating effect on the fabric, causes fibers to feel smoother and fluffs fibers to prevent the matting that forms harsh clumps during drying.

Testing:

Fabric Softener Sheets have been used in the AeroSmart dryer throughout its development. We have not found any issues with the sheets interfering with the dryer's sensing. Therefore we do not have a problem recommending the use of Fabric Softener Sheets.

What do we say in the User Guide:

If you want to use fabric softener sheets, you must ensure that they are labelled dryer safe. Always follow the instructions on the packaging. Do not place them in a dryer with warm clothes as there is a chance the fabric softener may stain clothes.

Only use a softener sheet once, then discard it.

Servicing

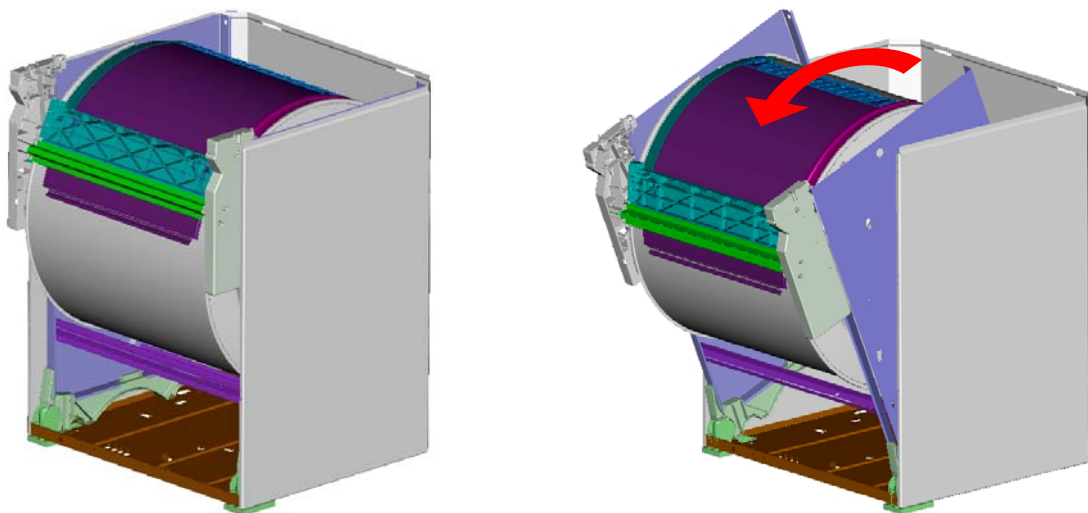
How does the Dryer Rock Out?

The dryer has been designed so all the internals and chassis are separate from the cabinet/wrapper. This makes it easier to service.

If possible unplug the dryer from the main power supply, or disconnect the circuit breaker.

Once the topdeck and console have been removed, disconnect the earth wire and sensor wire. The whole chassis can then rock and pivot out. This feature is unique to the AeroSmart™ dryer.

From a manufacturing point of view, the only difference between the gas and electric dryer is in the base panel. The heater and motor controller is bolted to the base panel. Both dryers have the same chassis.



Faults Codes

If a fault occurs that prevents correct operation of the dryer, the dryer will stop the machine will beep and a fault code is displayed. (The same sound AeroSmart™ makes at the end of the cycle). Pressing the Power button stops the beeps and leaves the fault code displayed, this is to help the service technician diagnose the problem.

Fault Code 1

Reason: Communications failure between sensor module and motor control module.

Background: The command for the direction and speed of the motor, and command for the heater, is received from the sensor module via a communications link in the connecting harness between the two modules. The motor control module then implements these commands. If the sensor module detects a failure in the communication link, the fault code is displayed.

Under normal operation, the sensor module will request "status" information from the motor control module every 5 seconds and will fault out if the motor control module fails to respond within 20 seconds, either because the motor controller has failed or the connection is not in order. When power is first turned on to the dryer, the sensor module will not fault until after the **Start/Pause** button has been pressed when communication is necessary for the dryer's operation.

Remedy:

- (1) Check the continuity of the module interconnecting harness.
- (2) Replace the sensor module.
- (3) Replace the motor control module.

Fault Code 2

Reason: Sensor module cannot locate drum gap.

Background: A drum tachometer, comprising of indentations in the drum that are detected via an optical transmitter and receiving device through a lens located adjacent to the drum, is used to determine the position of the drum gap. An automatic gain control is used on the signal to compensate for possible degradation of the signal over the life of the dryer. A corresponding "square wave" signal is connected to the motor control module, which uses the signal for speed control of the motor. The sensor module uses the signal for determining the drum's position, particularly for opening and closing the drum door, and is critical only while opening. The total number of tachometer graduations is known, and also a defined reference gap of 15 degrees. When either the total count of graduations is wrong, or no gap is found by the sensor module's logic, this fault is displayed. Note: The tachometer count can be monitored in the diagnostic mode.

Remedy:

- (1) Replace the sensor module.
- (2) Clean the drum sensed "bumps".
- (3) Replace the drum.

Fault Code 3

Reason: Drum is stalled; unable to move.

Background: A command is sent to the motor control to move the drum. The motor control uses the tachometer signal passed down from the sensor board to monitor the drum movement, and if this signal is not present the "stall" fault will be passed back. If the drum is seen to attempt to move, it is likely that the problem is in the tachometer signal rather than the coupling through the motor.

Note: The tachometer count can be monitored in the diagnostic mode, and if this does not change as the drum attempts to move, it is likely that the fault is not in the motor control but in the lack of a tachometer signal required by it.

Remedy: (1) Check drum movement mechanisms: belt, motor and motor harness.
(2) Replace the motor control module.
(3) Replace the sensor module.

Fault Code 4

Reason: The motor control module heat source option link read is invalid. (Not gas or USA electric models.)

Background: The motor control module has a set of option links that "tell" it what relays are installed on the board for either gas or electric heaters. This information is included in the status information read by the sensor module. If the fault is displayed it is because the motor control module has read an invalid combination of option links on its circuit board.

Remedy: Replace the motor control module

Fault Code 7

Reason: Motor current excessive.

Background: The motor drive electronics have been designed to operate with a maximum 15.4 lbs dry load, which translates to a 44 lbs wet load. When the motor controller is unable to open or close the door or rotate the drum at the required speed, the dryer will stop and display this fault code. The excessive loading may be due to overloading the dryer, in which case the user should remove some of the load before starting the dryer again. In the unlikely event that the mechanical system has jammed or failed in some way, this will need to be fixed to remedy the failure.

Remedy: (1) Free up the dryer. Remove overload or cause of jamming.
(2) Replace the motor control module.

Fault Code 8

- Reason: Exhaust sensor measures over temperature (185° F, 85° C).
- Background: The exhaust duct from the drum is monitored so that the temperature of the clothes load can be controlled, particularly as the load becomes dry. The highest temperature allowed for the hottest denim cycle is 150°F (65°C), at which time the element or gas is switched off. For permanent press the temperature limit is 140°F (60°C) and for delicate it is 127°F (53°C). If for some reason the measured heat exceeds 185°F (85°C), the dryer will switch off and the fault code will be displayed. At elevated temperatures the over-temperature thermal protection devices will switch the elements/gas off. If a short circuit occurs in the sensor (thermistor) circuit, this fault will also be displayed.
- Remedy:
- (1) Check the integrity of the sensor circuit. Approximate resistances at various temperatures are; 32°F (0°C) = 33 KOhms, 72°F (22°C) = 11 KOhms, 104°F (40°C) = 5 KOhms.
 - (3) Check the element integrity; continuity and open circuit to earth.
 - (4) Replace the motor control module.
 - (5) Replace the sensor module.

Fault Code 9

- Reason: Exhaust under temperature (14° F, -10° C).
- Background: An open circuit on the temperature sensor (thermistor) will display this fault.
- Remedy: Refer to steps for over temperature fault (fault code 8) above.

Fault Code 10

- Reason: Sensor module measures low voltage on actuator power supply.
- Background: The unregulated power supply that supplies the actuator and lid lock and sources the 5 volt regulator circuit has been detected as too low to operate the devices. The measurement is used for brown out detection and also to provide a pulse width modulation supply to regulate the lid lock and actuator.
- Remedy: Replace the sensor module.

Fault Code 11

Reason: Lid lock open circuit.

Background: After the lid is locked, the motor control module checks on the integrity of the circuit by checking that current is still flowing, and if not, assumes the circuit has gone open circuit and flags this fault.

Remedy: Check the lid lock harness and coil. If there is continuity through these, replace the sensor module.

Fault Code 12

Reason: Lid lock switching device failure.

Background: Before operating the lid lock, the motor control module checks the operation of the two main switching devices that operate the lid lock, and if either has failed, this fault is displayed.

Remedy: Check that there are no short circuits in the lid lock circuit. The resistance of the lid lock should be between 50 and 100 ohms. If the circuit is correct, replace the sensor module.

Fault Code 14

Reason: An unstable reading was received from the sensor module.

Background: The reading is required by the motor control module, and if unstable, it is unable to operate.

Remedy: Replace the sensor module.

Fault Code 15

Reason: An unstable reading was received from the sensor module.

Background: The reading is required by the motor control module, and if unstable, it is unable to operate.

Remedy: Replace the sensor module.

Fault Code 20

Reason: Door actuator stalled.

Background: A small electric motor is used, via a gearbox, to open and close the drum door. The sensor module monitors the movement of the motor, and if it detects the actuator as being tight and unable to move sufficiently, it will display this fault.

Remedy: (1) Replace the door actuator mechanism or grabber.
(2) Replace the sensor module.

Fault Code 21

Reason: Door actuator required excess voltage to move.

Background: The motor control module controls the speed of the small actuator motor through pulse width modulation, and if it requires excessive voltage to move, this fault code is displayed. This check is to guard against the condition where it may manage to move, but not sufficiently to clear the drum components, which then may cause damage when the drum is moved.

Remedy: (1) Replace the faulty door actuator mechanism or other sticking parts.
(2) Replace the sensor module.

Fault Code 22

Reason: Door actuator is open circuit.

Background: After switching on the actuator motor, the sensor module measures the current drawn, and if zero, it assumes the motor is not connected.

Remedy: (1) Check the connections of the actuator motor.
(2) Replace the sensor module.

Fault Code 24

Reason: Door actuator movement took too long.

Background: No end travel was detected on the actuator well after it should have fully moved.

- Remedy:
- (1) Check continuity of the door grabber circuit. Replace component as necessary.
 - (2) Replace the actuator mechanism.

Fault Code 29

Reason Brown-out data retrieval error.

Background: When the power is switched on to the appliance, the motor control module retrieves operating parameters from when it lost power. A check is made on the parameters, and if an error is detected it disregards the data and loads up default values instead, and will initiate the motor control module in the "idle" state. When this occurs the fault is set in fault history, but is not a critical fault displayed to the operator.

- Remedy:
- (1) If the fault occurs on every power on, replace the sensor module.
 - (2) Replace the motor control module.

User Warnings

For a user warning, the dryer will either pause, or “limp on”, and flash an L.E.D at the same time as sounding a user warning (the same sound AeroSmart™ makes when it is plugged into the wall).

User Warning 6

Reason: The door is unable to close due to either clothes catching or an excessive closing load.

Background: The mechanical teeth of the door closing mechanism are designed so that any fabric hanging out the door will prohibit the closing mechanism operating and the motor will stall. The sensor module will initiate the drum to reopen then attempt to close the door again. After the third failed attempt the Dryer will pause, the “user warning” sound. Pressing **Start** or **Power** will reset the warning.

It is also possible that a very heavy clothes load is positioned in the drum so that the motor is unable to lift the load. If this is the case, the user should either reposition the load or remove some of the load.

If either of the reasons stated above is not evident, it may be that there is some other reason the dryer closing mechanism is binding. If so, fix the source of the problem.

Remedy:

- (1) Remove the obstruction.
- (2) Reposition or remove some of the load.
- (3) Fix the cause of binding in the door closing mechanism.
- (4) Replace the motor control module.
- (5) Replace the motor.

User Warning 30

Reason: Lid lock failed to lock. “I can’t lock the lid”

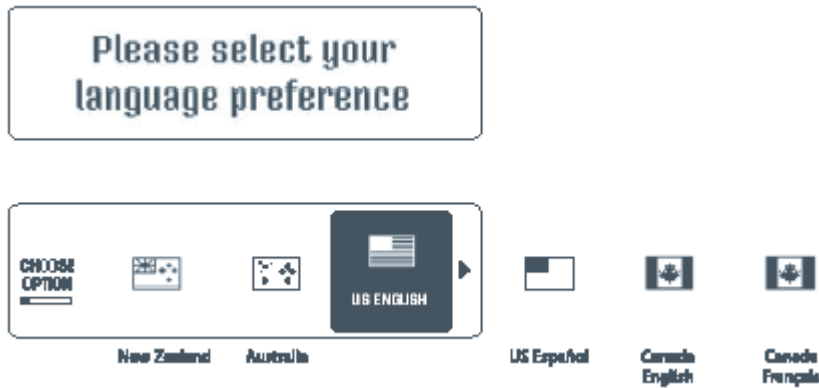
Background: When the user starts the dryer, multiple attempts are made to lock the lid, and with each attempt the lid lock display on the control panel is turned on. If the lid lock fails to operate, the dryer will return to the “paused” mode, the user warning will sound. The lid lock failure warning is retained as a “last fault” that may be retrieved in diagnostics mode, but is not a normal fault display.

Remedy:

- (1) Close the lid.
- (2) Replace the lid lock harness.
- (3) Replace the lid lock.
- (3) Replace the sensor module.

Customizing the Language that your AeroSmart dryer uses

The first time that you turn your dryer on and initial set-up mode will be initiated. This is to ensure that your AeroSmart is customized for your individual needs. The set-up mode will prompt you to select the language that you would prefer your AeroSmart dryer to use.



Using the SCROLL buttons, scroll to the language that you would like your dryer to use. Once the language icon has been highlighted, press SELECT to confirm your choice. Your dryer will now use this language and the initial set-up prompt will not appear again.

If you wish to change your language choice at any time, you can do this by simply selecting the LANGUAGE option in the SETTINGS MENU.

Demo Mode

To activate Demo / Showroom mode simply press 'SELECT' and 'START' together during the initial power-up sequence

